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THE OIL WEEKLY

WORLD OIL

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PIPE LINE OPERATIONS AND MANAGEMENT

APRIL, 1953

Exploration Issue

•

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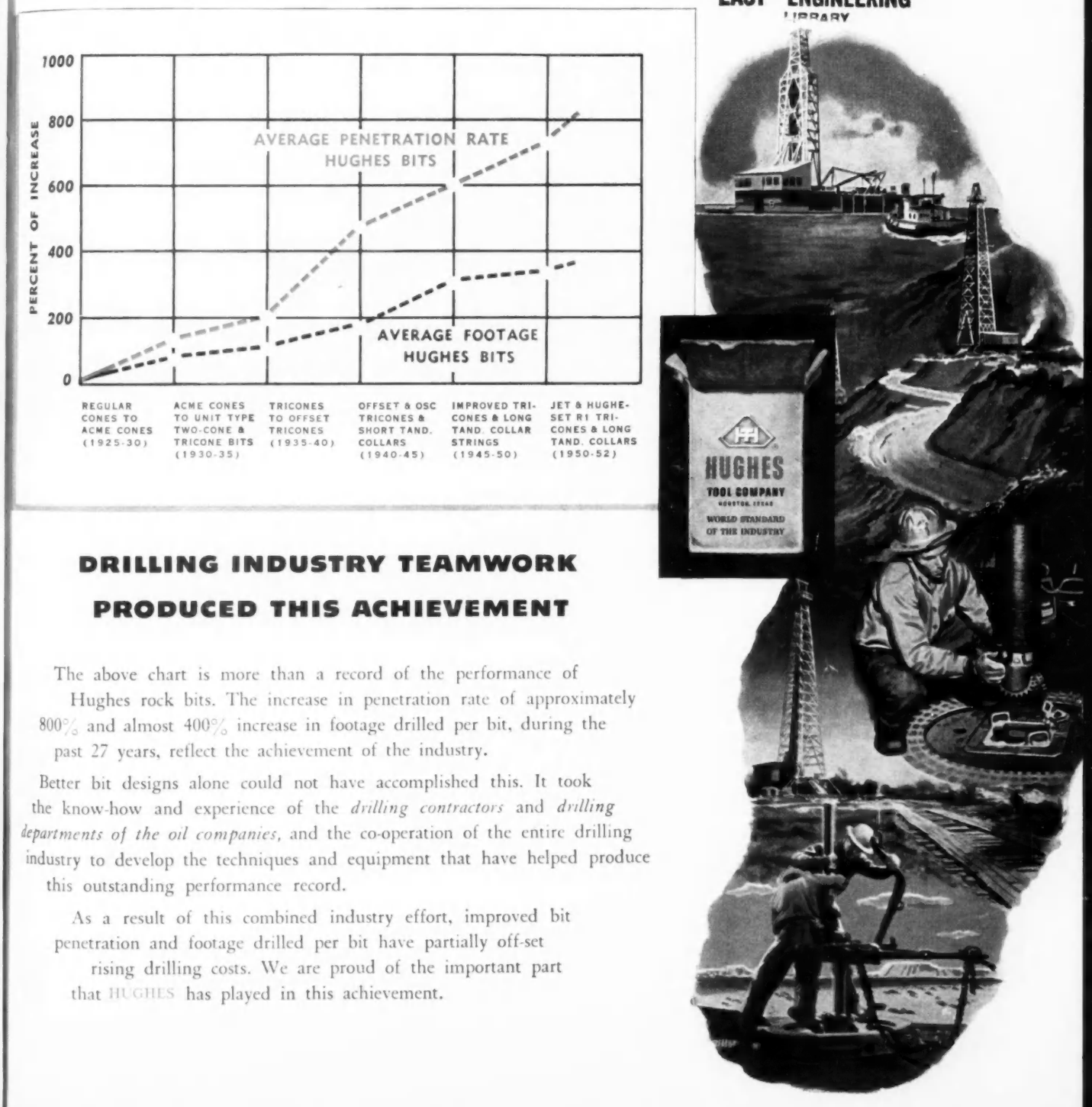

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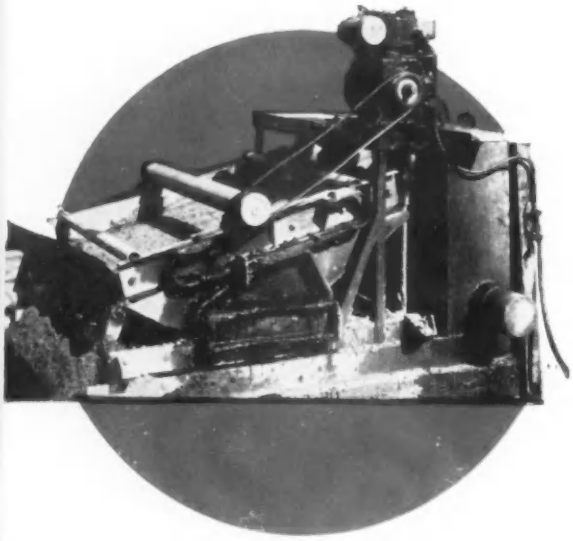

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WORLD OIL

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Turn the page for quick guide to the articles in this issue.

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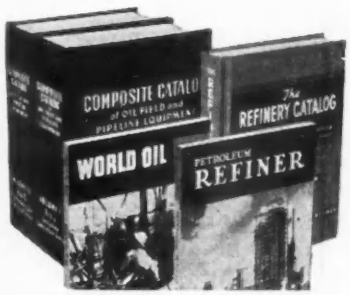
Single copies 50 cents (except special issues). Subscription price: domestic and foreign, $2 a year; 2 years, $3; 3 years, $4. WORLD OIL, published every month except semi-monthly in February and August. Entered as *The Oil Weekly* as second class mail matter December 23, 1916, at the post office at Houston, Texas, under the act of March 3, 1879. Advertising rates on application. Copyright, 1953, by The Gulf Publishing Company.

Indexed by Industrial Arts Index and Engineering Index



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A Quick Guide to

WORLD OIL this month . . . .

Current Outlook

Sinews of Industry—a timely speech by Robert G. Dunlop, president of Sun Oil Company. It was delivered before the AAPG meeting March 24 in Houston. **Page 52.**

√

A Western Hemisphere pact . . . firmness in the East. These are some of the comments by our readers on the Middle East oil situation, pinpointed by Publisher Ray L. Dudley in the February 15 issue of World Oil. **Page 61.**

√

What's the tidelands outlook? Twenty-thousand barrels of oil per day. That's the prospect for the continental shelf of the U. S. within five years, according to the National Petroleum Council's committee on submerged lands' productive capacity. And 600 to 800 million cubic feet of natural gas daily. Details of the report on **Page 64.**

√

New U. S. Reserves in 1952 fell far short of the high mark of 1951. But moderate net gains were recorded. The 3,306,126,000-barrel total was smallest volume proved up since 1947. Canada also recorded a net increase. For the annual API and AGA reserves reports, see **Page 66.**

Exploration

Three timely discussions are presented in this annual Exploration Issue . . . the guest editorials by the immediate past presidents of the three exploration societies. This year they're written by Curtis H. Johnson, SEG; Morgan J. Davis, AAPG, and Clifford C. Church, SEPM. Pages **73, 74 and 75.**

Names and news . . . from the annual joint meeting of the American Association of Petroleum Geologists, Society of Exploration Geophysicists and Society of Economic Paleontologists and Mineralogists held March 23-26 in Houston. The meeting took a sweeping review of recent developments and a penetrating look at the future of oil exploration. **Page 76.**

√

Geophysical activity zoomed during '52. The industry's most authoritative report on the past year's activity is made annually by the Committee on Geophysical Activity, headed by Dr. E. A. Eckhardt. The report contains total crew months activity of seismic and gravity methods and compares these figures with production and reserves. The full report begins on **Page 82.**

√

The AAPG has a new home. The association moved into its new headquarters in Tulsa, Okla., on March 20. Picture and story on **Page 88.**

√

What's the catch? There's plenty of oil for the future. There's plenty of technical ability to develop fields. But . . . restrictive laws and an insecure political atmosphere are growing threats to exploration and development activities. Just how grave the danger is and what the trend could be are discussed by World Oil Editor Warren L. Baker and International Editor Don Kliewer on **Page 90.**

√

More valuable information about the Spraberry Trend is in the concluding part of a two-part article. G. Frederick Warn, Geology professor at Texas Technological College, rounds out his discussion and comes up with some conclusions on why *Fracturing Is Significant Feature of Spraberry Structural Conditions.* **Page 100.**

√

Here's a new device which overcomes some serious economic and operating disadvantages in handling seismograph cables. When properly installed on a

Use this condensed information on this month's principal articles. Run through these digests rapidly. Check those you want to read first.

truck bed, the device picks up seismograph cable from the ground and deposits it in a random heap in truck bed. When reversed, it pays out cable from truck to ground. For full details on this timesaving device developed by The Carter Oil Company, see **Page 107.**

√

A tax expert's views on capitalization of geological and geophysical expenditures. Are your wildcat ventures based largely on the tax picture rather than on actual possibilities? This situation has developed since 1942 due to the scarcity of leftover capital for good oil-finding risks. The problem, how it works and what can be done about it are clearly presented in the first of a two-part article beginning on **Page 112.**

Drilling

Some helpful ideas where competition is keen . . . where drilling is slow and expensive . . . West Texas. If you are interested in decreasing rig operating costs and increasing your drilling rates, turn to **Page 141** and read how other people are making hole. *Current Drilling Practices in West Texas* should hit the spot with anyone interested in drilling.

√

How to get the right joint in the right place. Money can be saved by careful design of casing strings. Combination strings have proved satisfactory and economical. Methods may vary but the basic factor is safety . . . the right string has to be set in the right place. For a detailed description and a sample casing tally sheet, see **Page 144.**

Another report from the Williston Basin . . . where the problems are ponderous but are being solved by perseverance, ingenuity and experience. A recent Amerada well established a record of 28 days as compared to 298 days for the first well in area drilled in 1951. **Page 148.**

√

What about compressed air? Field tests in both shallow and deep wells have indicated advantages in compressed air as circulating medium for removing cuttings from rotary drilled boreholes. It may also help solve a big drilling headache—lost circulation. For a number of cases where the technique has paid off, see **Page 155.**

√

Luxury and efficiency afloat. Take a trip through one of the most efficient submersible drilling barges ever constructed. **Page 164.**

√

A trap that features chemical mixer and storage space. It's another example of the ingenuity that goes into oil field equipment. It is designed with elevating chemical feed system. Each skid base is a water or steam carrier. Incorporated jets permit rapid discard of cut mud, water or other undesirable fluids. This installation was designed with the particular problems of the Texas Gulf Coast area in mind. **Page 174.**

Production

Don't miss this idea . . . if you're installing a tank battery in a new field or area, or revamping existing

Next month . . . The Exposition Issue!

Full information about the equipment on display at the 1953 International Petroleum Exposition will be presented in the May WORLD OIL. Special attention will be called to products that are new or improved during the year. For oil men unable to attend the show, this will be a next-best look at drilling, production and pipe line exhibits as new as tomorrow. And for those going to the show, the issue will focus attention on exhibits of special interest. Each new product on exhibit will be listed with a special number to make it easy to obtain more information by merely using a handy, prepaid postage insert card. Moreover, all exhibitors at the show will be listed, showing the products displayed and booth location.

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batteries. Results, design and installation of Shell Oil Company's automatic gauging and transfer battery in the East Texas field are presented in this issue, beginning on **Page 195.**

√

Stuck casing is not always due to the production packer. Recent developments in strain gauges have demonstrated that congealed mud placed in casing annulus during original completion is frequently the cause of stuck tubing. Use of the string-shot backoff method has made possible recovery of tubing at less cost. For details of this new technique, read *Mud-Stuck Tubing Recovered by String-Shot Backoff Method*, **Page 200.**

√

It pays to know your petroleum. This conclusion of a two-part article takes up factors that must be considered in the optimum production of a given reservoir. The author discusses:

- Sampling and testing
- Gas liberation
- Retrograde condensation

And substantiating the author's discussion are laboratory data presented by another reservoir engineer. **Page 208.**

√

How to check for channeling in water-floods. Do you suspect injected water of channeling into nearby producing wells in a water-flood project? Here's a quick and positive method of finding out what's happening. Boron compounds, such as borax and boric acid, when mixed with the injection water, can be easily detected in produced waters. Three field experiments illustrate use of such tracers. **Page 214.**

√

A new aid in squeeze cementing—four perforations in the same horizontal plane are now possible due primarily to developments in shaped charges. Field and laboratory tests indicate excellent results when squeezing cement through four-way perforations to isolate water or gas from the oil zone. Development, lab background testing and some applications on **Page 222.**

Pipe Line

Map of the Month. Only five years old, Texas Gas Transmission Corporation soon will have a daily pipe line capacity of 1.06 billion cubic feet. **Page 252.** Other pipe line features:

- Rules of Thumb Page 249
- Pipe Line Pete Page 250
- Pipe Line Construction Page 256
- Pipe Line Men in the News Page 265
- Pipe Line Hints Page 268

International

An oil law allowing freedom . . . and certainty to oil companies can work wonders for any country with prospective formations. What's the new petroleum law doing for Peru? **Page 275.**

√

A giant pressure maintenance program is being put into operation by Creole Petroleum Corporation in Venezuela. They'll erect a unique plant in Lake Maracaibo in one of the largest gas injection operations ever undertaken. For details see **Page 278.**

√

Australians are no strangers to oil men. Even though Australia has not one productive oil well, exploratory activities have been carried on in the country for a long time. But perhaps none has has such rough going as WAPET—a joint venture of Caltex Oil (Australia) Pty., Ltd., and Australia's Ampol Petroleum, Ltd., **Page 282.**

√

Alaska is scene of new exploratory effort. Phillips Petroleum Company and the U. S. Interior Department have completed negotiations. For a geological digest of the area, see **Page 290.**

For news of the latest and best in equipment, see Pages 307-316

Looking Ahead

Middle East may shape future trend of crude prices. Price weakness is developing. It could have repercussions in U. S. Success of Iran in peddling crude to Italian company, Supor, at half of world market prices may be first tipoff. Such concession would be windfall to Italy, currently supplied from other Middle East sources. While Persian Gulf prices have continued firm over two years at $1.75 a barrel for 36 gravity crude, posted export prices at Mediterranean pipe line terminals have been trimmed 12 cents. One major Middle East exporter is actively soliciting new customers on U. S. East Coast.

Completion of $86 million crude line by West Coast Pipe Line Company is hoped for by end of '53. Line will extend from West Texas to Los Angeles. It holds priorities assuring pipe deliveries this year. Main line of 24- and 26-inch pipe, about 955 miles long will first deliver 175,000 barrels daily using seven pump stations . . . ultimately 300,000 barrels daily with 12 stations.

Petroleum industry's sulfur production is due to climb. Output (from natural gas and refinery gas) will exceed its own heavy consumption (mostly as sulfuric acid for refineries) by 100,000 tons in '53 . . . by 200,000 tons in '54. To meet sulfur shortage, oil companies since 1950 have built 12 plants for sulfur recovery, are nearing completion of 13 and have plans for at least three more.

Drastic curtailment of Mexico operations has been reported. Petroleos Mexicanos, government oil monopoly, is said to be shutting down rigs. Action follows economy drive in all branches of government ordered by President Adolfo Ruiz Cortines. Cortines reportedly is insisting on operation within budget and that every agency pay back debts before charting future work. Pemex is believed out-of-bounds on its budget and hard pressed for cash.

More market for Kuwait crude will be provided by new Anglo-Iranian Oil Company 80,000-barrels-per-day refinery near London. Plant boosts Britain's refining capacity to 450,000 barrels daily, largest in Western Europe, and raises Western Europe total to 1,600,000 daily. It puts Anglo-Iranian's refinery runs back up to 340,000 a day, after Abadan, Iran, plant shutdown cut them from 630,000 to 130,000.

Oil in Los Angeles' outer harbor is a possibility. Oil-bearing structure has been reported near breakwater entrance. It lines up with Wilmington field, four miles northeast, and Signal Hill field, another four miles northeast, apex to apex.

How to free big part of 100 billion barrels of crude oil? Oil in existing fields that is not now recoverable by present methods. Improved techniques could help. And stronger prices would most effectively stimulate development of improved techniques.

This is the machine age. It is estimated that by 1960, man will do only 3% of physical work performed in U. S. Animals 1%. And machines 96%. Figures in 1930 were: man, 4%, animals 12% and machines 84%. In 1859—before oil industry started—it was: man 15%, animals 79% and machines 6%. Petroleum has had major role in lifting burdens off man's shoulders. Of today's energy, more than half comes from oil and natural gas.

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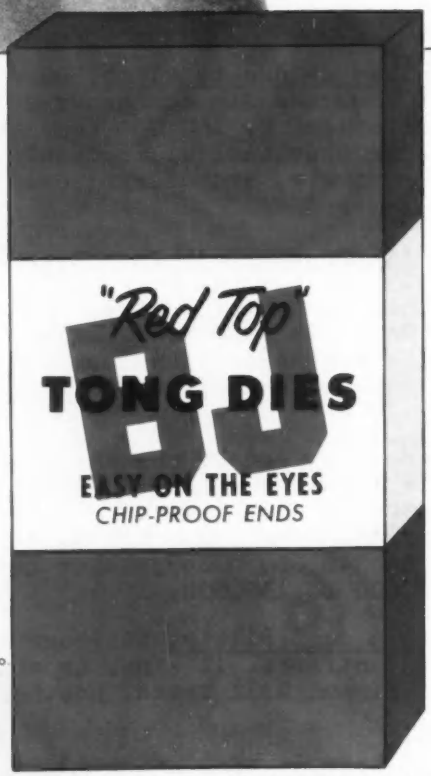

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Publisher's Page

Our Time-Saver Catches On

WORLD OIL takes it as a compliment that one of its fine contemporaries recently has adopted the time saving idea which WORLD OIL put into effect on its index pages last November.

Business papers nowadays are filled with sound ideas of practical value to people in the industries or professions they serve. The primary interests, however, of different people within an industry are such that few subscribers of a business paper will find every article in any issue of the same practical value.

Thus the reader and the editor have an identical problem: How can the reader select, for high priority reading, the articles most likely to be beneficial to him?

This is not a new problem, but radio, television and a multitude of publications have helped to make it an increasingly difficult one.

• • •

WORLD OIL, on pages 2, 3, 4 of its November issue, put into effect, the results of a long period of study. *It amplified the index material published on Page 1 and gave the reader a quick insight into the articles he might most likely prefer to read first.* Every issue since has followed the same policy.

The idea was instantly popular. Personal comments from subscribers have been universally favorable to the plan. These comments have come from every class of reader.

• • •

SHORTLY AFTER WORLD OIL put the idea into effect, its sister publication, PETROLEUM REFINER, adopted a similar plan. A leading publication in the chemical field shortly thereafter adopted an idea very similar to that followed by WORLD OIL and now one of our very good friends in the oil industry has accepted the idea as sound editorial practice.

We sincerely hope that the other publications serving the oil industry will come to this very practical way of helping to save the reader's time.

Ray L. Dudley

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Oil Companies Can Strike a Blow for Free Enterprise

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And at not a penny's cost to the American taxpayer!

If it elects, the U. S. Government could take advantage of this potent wedge in the Iron Curtain.

This opportunity is developing hard on the heels of two developments:

- Turkey's recent admission that its government oil monopoly has failed to provide the oil so desperately needed to fuel its technological advances.
- To satisfy domestic oil requirements, Turkey has chosen to invite into its borders foreign capital. Standard Oil Company (New Jersey) has already received authorization to send a reconnaissance party into the nation.

  It is strongly indicated that more than one U. S. company has been asked to join discussions aimed at effecting a plan to guarantee foreign capital the freedom of operations necessary to oil exploration and development.

By this overture, Turkey has freely admitted what a growing number of governments and more and more persons steadfastly refuse to acknowledge: that only giant private companies are financially and technically equipped to adequately explore and develop oil in large volume.

In Turkey, once private companies are offered mutually satisfactory working conditions, the world could see the fashioning of a major reversal to communism.

Situated on the border of Russia and sharing the Black Sea coast with Bulgaria and Roumania, the nation will be the focal point of interest throughout the Balkans. Harshly-dealt-with satellites whose oil fields have been ruined by Russia will learn at near first hand what private companies can do. If oil is found in Turkey, they will see that nation prosper unlike any under Red control.

And even if no volume oil reservoirs are discovered, they likely will see a buoyed economy. In Canada's Peace River area, no oil has been discovered in more than two years of exploration yet, millions of dollars have been poured into the hope that it will.

Expert petroleum technologists will be operating next door to Russia, thus erasing the U.S.S.R. hope for a complete circle of buffer nations to prevent any Western propaganda from trickling through its border.

Yugoslavia's Marshal Tito, whose country recently signed a Balkan pact with Greece and Turkey which firmed up the West's right flank, can be expected to watch closely the results of any private company operations should they begin in Turkey.

Though identified with the West, Tito may find his position greatly enhanced. Even to the Communists, it must be evident that Stalin's surviving party leaders are hesitant, uncertain—even haranguing—over the spoils. And the party adherents can admit to themselves now that Stalin failed in many of his objectives, thanks to the West, and that Tito purposely drew his enmity over a difference in policy—and kept his country intact.

Indeed, if U. S. companies enter Turkey, they'll be "on the spot." But certainly the peoples of the democracies could hope for no better representatives than the oil companies. And they couldn't get a better deal, either. Not even if it cost the taxpayers cash.

Steady Prices Refute Monopoly Charges

Recent experience directly refutes charges that the petroleum industry is monopolistic and acts in concert against the consumers, as the recent Democratic administration would have the public believe.

Shortly after petroleum prices were decontrolled in mid-February, a leading supplier on the East Coast raised prices of motor fuel by a fraction of a cent. Other major marketers in the area held the line, and competitive conditions forced the increased prices back to former levels after a week.

The events discredited countless charges of proponents of a controlled economy that removal of price ceilings on petroleum would bring a general wave of price increases from wellhead to service station pump. Except in Pennsylvania fields and in California, where retail and field prices have been below levels necessary to provide proper incentive for needed development, there have been no general price increases. True, there have been scattered boosts in motor fuel prices, but at the same time, retail gasoline prices have been lowered in a number of other areas. Fuel oil prices were reduced twice in the East during the normally coldest month of the year.

The only workable regulation over petroleum prices is the control that results from the normal economic function of supply and demand. Given the proper incentive to find and develop new oil supplies, the petroleum industry will always provide consumers with ample refined petroleum products at reasonable prices.

Suit on Scurry

Minority interests indicated they would test in courts the legality of the Scurry County, West Texas, unitized repressuring project, recently approved by Texas Railroad Commission. About 1900 producers and royalty owners signed request for unitization of 47,450 acres in Kelly-Snyder and Diamond "M" (Canyon reef) fields.

They constituted 96.58 percent of the working interest and 83.84 percent of the royalty interest. Plans call for injection of both gas and water, wholly at expense of operators (not royalty owners), including spending of $60 million to bring water from a lake on nearby Colorado River.

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Report from the Observatory

Supply Continues Excessive

By **RAY L. DUDLEY,** Publisher, and **WARREN L. BAKER,** Editor

FURTHER REDUCTION of United States' producing and refining rates is imperative during the next few months to avoid creating a serious economic plight due to excessive stocks. The first three months of 1953 has seen a sharp increase in import rates more than offset the reduction made in domestic crude output. Consequently, supply has continued to outrun demand, as it did during the late months of 1952.

This situation has resulted in an undesirable increase in stocks of both refined products and crude oil. High refining activity has tended to somewhat hold down the gain in crude stocks, but on the other hand has caused product inventories to advance.

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IMPORTS ROSE to an average of better than 1 million barrels per day during the first two months of this year, an increase of 13 percent over the like period of 1952. Crude imports averaged 590,000 barrels per day, up 20.7 percent over the first two months of last year. During January and February of 1953, runs of foreign crude to U. S. refineries increased by 29.5 percent over the corresponding period of 1952, while runs of domestic crude to refinery stills rose only 3.9 percent.

At their current rate, imports of crude and products account for about 14 percent of the total U. S. supply, the highest ratio since 1922.

Meanwhile, U. S. crude production so far this year has averaged above 6½ million barrels daily, about 200,000 barrels per day over the first three months of 1952.

Total U. S. production in February was down 100,000 barrels from last November, all accounted for by Texas' trimming of nearly 150,000 barrels a day off its recovery. Texas producers will feel another pinch in April, the production allowable for that month having been cut another 119,366 barrels per day, following an 118,000 barrels reduction for March. This leaves the state's permissible flow at 2,922,875 barrels per day, lowest since last July.

Despite curtailment of U. S. production, the nation's crude stocks on March 7 were 4 million barrels greater than at the beginning of the year and 15 million barrels above year ago levels.

DEMAND HAS SHOWN only a modest rise over the like period of last year; January was up 3.4 percent, February increased 4.9 percent and preliminary indications are that March demand will be around 4 percent over the same month in 1952.

This rate of growth is in line with the industry's normal experience. However, it is less than the increases which took place in 1950 and 1951, when the Korean war and the Iranian industry shutdown greatly stimulated demand for U. S. oil.

The industry needs to revise its planning in line with the more normal gains in demand which have existed during the past 12 months.

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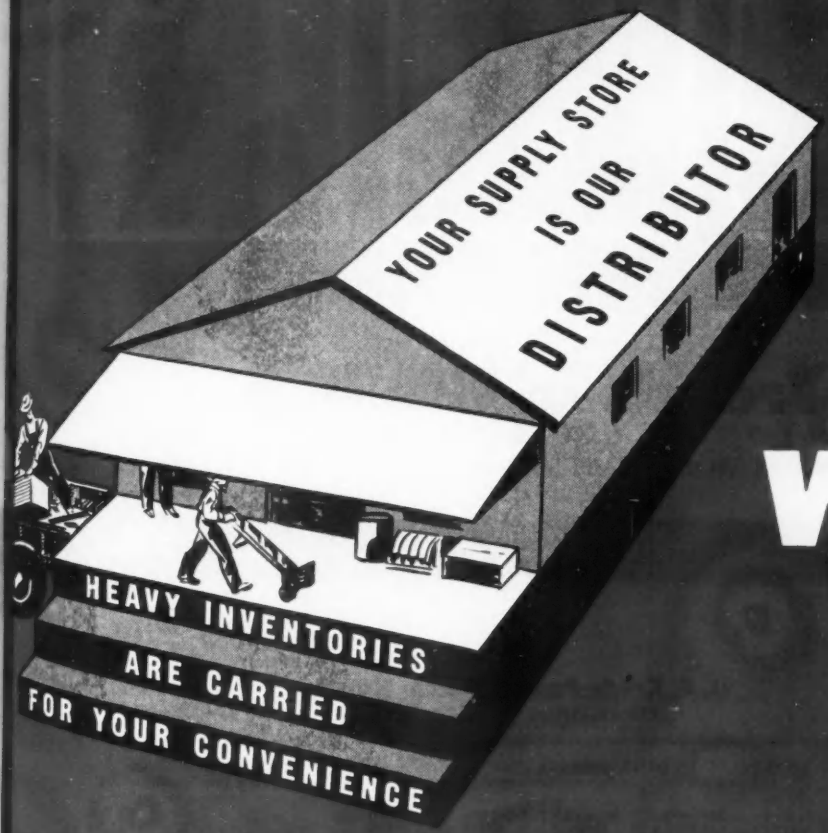
REFINED PRODUCT STOCKS also are high. Inventories of the three principal products were 23 million barrels higher on March 14 than a year ago.

U. S. stocks of motor fuel reached an all-time peak of nearly 161 million barrels, 6 million above a year ago in contrast with being only 1 million greater than the year before at the start of the year. Inventories of motor fuel also are dislocated, nearly all the increase being located in the East Coast region. Inventories in the East are almost 9 million barrels above this time 1952. The Midwest also has shown some increase. Other regions have less stocks on hand.

Less than expected demand for distillate fuel oil due to mild winter weather over much of the nation has caused smaller drafts on these stocks than anticipated. Consequently, distillate inventories in mid-March were 9 million barrels greater than a year ago. Most of the increase has been on the East Coast, which is up 8 million barrels over 12 months ago.

Refinery runs are going to have to be watched closely to prevent manufacturing too much distillate now that the heating season is over. High refinery runs also could work to the disadvantage of motor fuel stocks, retarding the rate of reduction due to commence as motoring increases. Lower runs will hurt crude oil needs, but production will have to be trimmed sufficiently to fit the situation.

WHAT You Need



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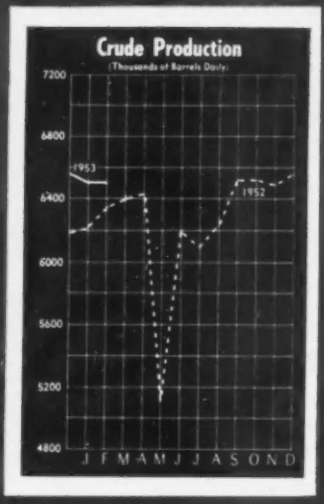
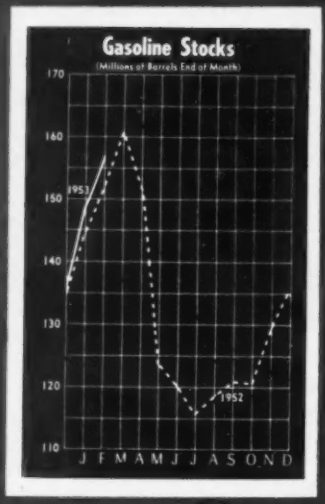
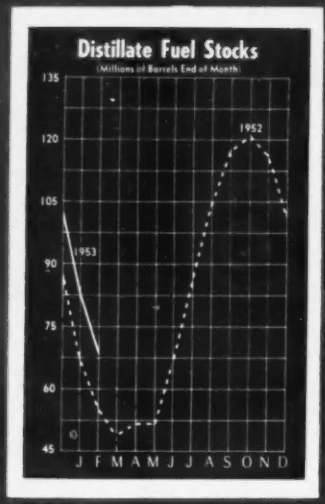
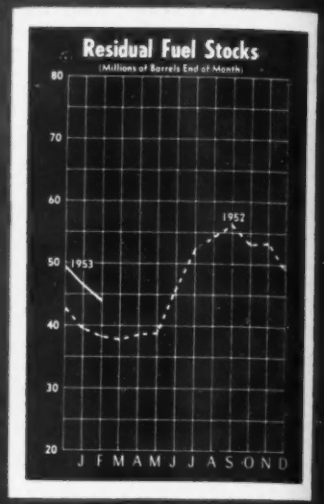


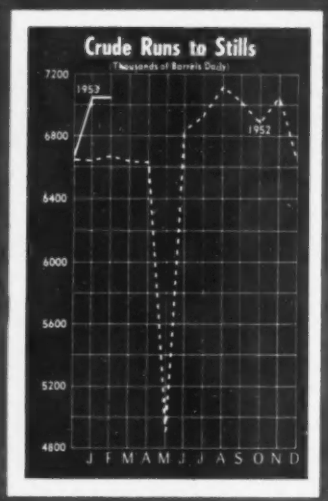


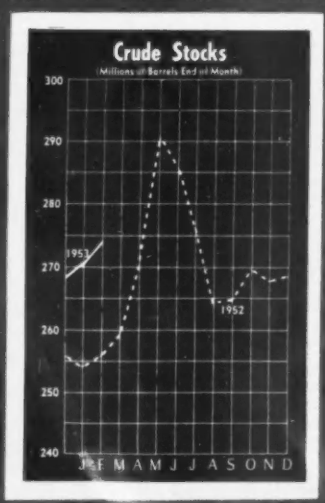




Petroleum Trends in the U. S.

By **CECIL W. SMITH,** WORLD OIL Staff

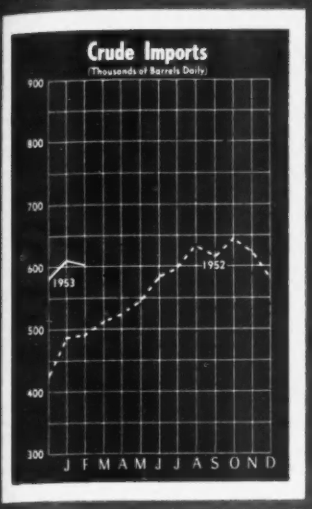


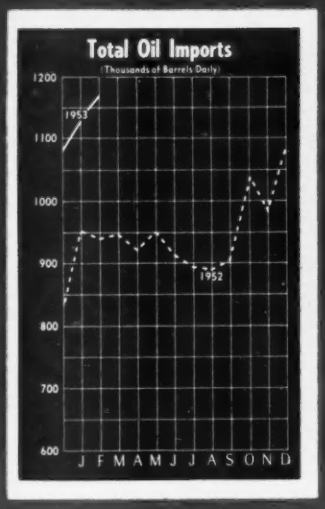


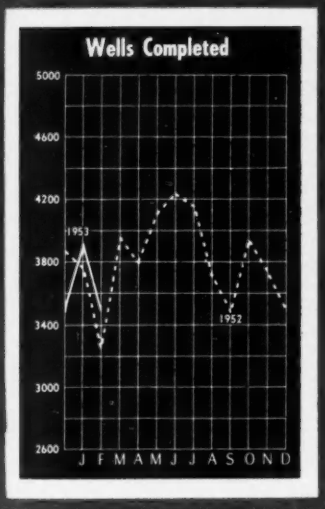
U. S. Crude Production by States

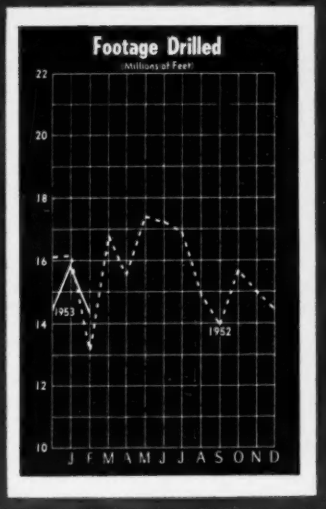
(THOUSANDS OF BARRELS)

STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION First Two Months		
	February, 1953	January, 1953	February, 1952	% Diff. February, 1952-1953	1953	1952	% Diff. '52-'53
Alabama	4.2	3.7	2.4	+ 75.0	232	159	+ 45.9
Arkansas	78.3	76.9	80.7	— 3.0	4,576	4,836	— 5.4
California	987.4	991.4	975.8	+ 1.2	58,381	58,428	— 0.1
Colorado	87.7	87.0	77.1	+ 13.7	5,155	4,674	+ 10.3
Florida	1.5	1.6	1.7	— 11.8	91	102	— 10.8
Illinois	166.1	164.4	158.0	+ 5.1	9,748	9,501	+ 2.6
Indiana	34.0	33.6	30.1	+ 13.0	1,993	1,825	+ 9.2
Kansas	337.8	329.9	331.7	+ 1.8	19,687	19,658	+ 0.1
Kentucky	29.8	30.1	35.9	— 17.0	1,766	2,136	— 17.3
Louisiana	700.9	692.8	647.5	+ 8.2	41,102	38,774	+ 6.0
North Louisiana	115.0	113.8	117.1	— 1.8	6,748	7,105	— 5.0
South Louisiana	585.9	579.0	530.4	+ 10.5	34,354	31,669	+ 8.5
Michigan	35.1	35.0	37.7	— 6.9	2,077	2,253	— 7.8
Mississippi	96.5	96.1	99.3	— 2.8	5,681	5,999	— 5.3
Missouri	0.1	0.1	0.1	.....	2	5	— 60.0
Montana	30.1	31.0	26.2	+ 14.9	1,805	1,492	+ 21.0
Nebraska	12.8	11.9	5.5	+ 132.7	727	330	+ 120.3
New Mexico	176.1	176.0	161.5	+ 9.0	10,387	9,517	+ 9.1
New York	13.0	13.1	12.0	+ 8.3	770	705	+ 9.2
North Dakota	14.6	14.8	0.2	+7200.0	867	10	+1230.0
Ohio	8.7	9.2	8.6	+ 1.2	528	510	+ 3.5
Oklahoma	535.1	529.9	540.3	— 1.0	31,411	32,051	— 2.0
Pennsylvania	28.3	27.9	30.0	— 5.7	1,659	1,805	— 8.1
Tennessee	.....	0.1	.....	.....	2	2	.....
Texas	2,938.8	2,925.1	2,901.6	+ 1.3	172,962	170,550	+ 1.4
Dist. 1: South Central	36.8	37.4	33.0	+ 11.5	2,189	1,963	+ 11.5
Dist. 2: Middle Gulf	167.4	167.0	169.8	— 1.4	9,863	9,878	— 0.2
Dist. 3: Upper Gulf	497.3	499.7	498.6	— 0.3	29,414	29,204	+ 0.7
Dist. 4: Lower Gulf-S.W.	266.9	264.0	266.3	+ 0.2	15,656	15,509	+ 0.9
Dist. 5: East Central	52.3	52.9	62.5	— 16.3	3,104	3,433	— 9.6
Dist. 6: Northeast	391.6	393.5	399.2	— 1.9	23,163	23,750	— 2.5
Dist. 7-B: North Central	111.4	112.2	88.4	+ 26.0	6,599	5,170	+ 27.6
Dist. 7-C: West Central	178.6	175.8	141.8	+ 26.0	10,449	8,144	+ 28.3
Dist. 8: West	972.1	954.7	1,005.2	— 3.3	56,816	58,268	— 2.5
Dist. 9: North	188.4	188.0	162.3	+ 16.1	11,104	10,495	+ 5.8
Dist. 10: Panhandle	76.0	79.9	83.2	— 8.7	4,605	3,002	+ 53.4
Utah	5.2	5.1	4.4	+ 18.2	305	248	+ 23.0
Virginia	0.1	0.1	0.1	.....	6	2	+ 200.0
West Virginia	7.3	7.2	7.7	— 5.2	427	453	— 5.7
Wyoming	202.8	209.2	191.3	+ 6.0	12,164	11,341	+ 7.3
Total United States	6,532.3	6,503.2	6,367.4	+ 2.6	384,511	377,366	+ 1.9









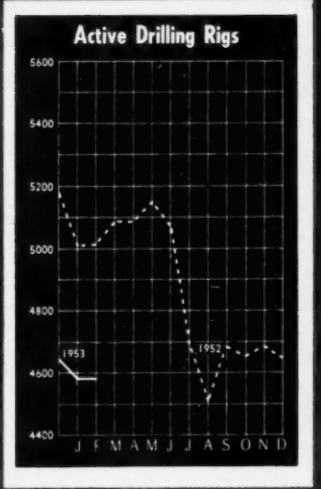
- **Crude stocks continue up**
- **New wells ahead of 1952**
- **Imports remain high**
- **Fewer rigs doing the job**

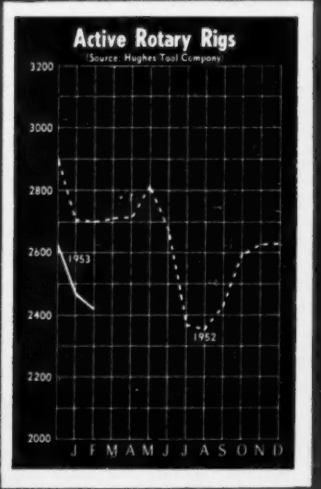
Crude Oil and Refined Products Trends

(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1951:											
January	5,907	6,450	243,107	2,962	136,145	1,427	62,163	1,368	41,251	499	977
February	5,930	6,562	235,247	2,906	145,184	1,419	51,348	1,382	40,716	468	937
March	6,052	6,469	233,824	2,908	149,679	1,327	46,744	1,348	38,366	483	861
April	6,127	6,183	243,180	2,821	147,679	1,171	48,239	1,230	37,623	511	871
May	6,170	6,436	248,418	3,031	141,658	1,210	59,272	1,265	39,879	518	876
June	6,130	6,575	248,170	3,100	137,000	1,254	72,140	1,277	42,398	563	876
July	6,141	6,462	250,847	3,091	130,931	1,228	84,282	1,275	46,320	546	788
August	6,232	6,539	254,276	3,114	124,202	1,237	94,028	1,226	48,365	529	780
September	6,261	6,558	254,900	3,127	124,530	1,282	104,082	1,228	49,608	500	744
October	6,375	6,446	262,266	3,105	118,864	1,295	109,544	1,224	49,573	421	769
November	6,272	6,609	261,100	3,130	122,723	1,358	101,666	1,304	46,491	425	802
December	6,182	6,646	255,783	3,150	134,867	1,442	86,619	1,313	42,853	423	834
1952:											
January	6,217	6,640	254,007	3,094	144,339	1,456	66,969	1,338	39,523	488	951
February	6,367	6,673	255,900	3,109	151,912	1,528	55,369	1,322	38,295	491	940
March	6,388	6,640	259,126	3,069	160,689	1,400	48,750	1,274	37,971	510	947
April	6,429	6,435	270,679	2,995	151,890	1,312	51,634	1,253	38,561	539	922
May	5,107	4,905	290,813	2,295	123,656	982	51,648	979	38,821	545	951
June	6,197	6,825	285,964	3,169	120,166	1,455	65,911	1,228	45,688	581	911
July	6,093	6,927	275,951	3,295	116,566	1,475	85,775	1,237	52,245	597	892
August	6,219	7,118	264,368	3,377	118,592	1,514	104,257	1,252	54,061	632	879
September	6,518	7,017	264,723	3,428	120,991	1,502	117,252	1,230	56,200	615	932
October	6,518	6,883	269,776	3,301	120,062	1,458	120,721	1,203	53,052	643	1,037
November	6,487	7,049	267,852	3,416	129,509	1,510	116,096	1,299	53,069	624	984
December	6,634	6,952	271,928	3,361	136,028	1,509	99,582	1,302	48,706	603	1,165
1953:											
January	6,503	7,058	270,641	3,378	149,443	1,556	82,148	1,292	46,356	609	1,129
February	6,533	7,055	274,123	3,371	157,612	1,515	68,025	1,272	44,432	565	1,004
Feb., 1953 Change:											
In Month	+30	−3	+3,482	−7	+8,169	−41	−14,123	−20	−1,924	−44	−125
In Year	+166	+382	+18,223	+262	+5,700	−13	+12,656	−50	+6,137	+74	+64
Week Ended:											
3-14-53	6,450	7,060	273,357	3,307	160,869	1,506	62,545	1,331	42,284	741	1,135
3-15-52	6,404	6,693	253,111	3,108	154,740	1,460	51,665	1,283	36,417	471	834

Source: Data for last two months from API; prior monthly data from Bureau of Mines.





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News Analysis

Petroleum Industry Looking Forward To Early Return of Competitive System

Petroleum industry's procurement of necessary steel, cooper and aluminum will return to a free market July 1, after two years of government allocation under the Controlled Materials Plan. That allocation plan was created under the authority of the Defense Production Act, which is scheduled to expire June 30.

The Eisenhower Administration has established procurement regulations to cover essential defense and atomic energy programs, known as Defense Materials System, which will become effective July 1, provided necessary legislation is passed by Congress.

The only exception to the broad decontrol of materials listed so far will be nickel-bearing stainless steel, a critically short item which has some application in refineries. Regulations governing defense and atomic energy programs will contain provisions for future control over materials essential for national defense that may become in short supply. Steel industry officials estimate that the necessary steel requirements for direct defense industries and the atomic energy program can be comfortably supplied with set-asides of no more than 12 percent from the anticipated 1953 rate of steel production.

Return to Normal. Removal of price controls in mid-February and the planned decontrol of metals at the end of June will return petroleum industry operations to a normal competitive system, with the possible exception of some controls over procurement of military aviation gasoline, which is expected to pass to the Department of Interior's reactivated Oil and Gas Division.

Petroleum Administration for Defense, which was established under the Defense Production Act in the Interior Department, commenced the gradual process leading to its expected demise a month ago. Three divisions—gas planning, natural gas production and processing, and distribution and marketing—have been abolished. By the end of March the agency's staff had been reduced to 200 from its peak of 330 full and part-time employes.

While PAD is not accepting applications for third quarter allocations for oil country tubular goods and line pipe in view of the anticipated end of government controls over metals, the agency will continue to receive and process requests on form PAD-15 for emergency casing, tubing or drill pipe for wildcat operations. Should some controls over oil country tubular goods be continued past June 30, PAD states ample notice will be given operators to file for their third quarter steel allocations.

The petroleum industry has been operating under an "open end" allocation system since the start of March, which permits steel mills to accept orders from all customers after all CMP tickets have been filled. While supplies of oil industry steel can be expected to remain tight for a few months, steel industry estimates are that supplies will be back to normal to cover the needs of the industry during the second half of the year.

National Production Authority estimates that production of oil country tubular goods in 1953 will increase 22 percent over the rate of 1950 and 1951 and that the gain in 1954 and 1955 should be 45 percent and 50 percent, respectively, over the 1950-51 rate. Estimated production of drill pipe, tubing and casing in 1954 was placed at 2,638,000 net tons, of which 504,000 tons would come from new facilities. The 1955 supply is expected to reach 2,747,000 net tons.

It's Contract Time Again for OWIU

It's time to talk contract with the Oil Workers International Union.

Contracts have come open at Eastern units of Gulf Refining Company, Sun Oil Company and Socony-Vacuum Company, among others, and industrial relations experts throughout the land are listening for a barrage of demands to determine which are loud-sounding blanks and which are true missiles that will soon explode on the Gulf Coast, where lies the greatest concentration of union strength. (Contracts of The Texas Company and Continental Oil Company are up in May, Sinclair Refining Company and The Pure Oil Company in June, and Magnolia Petroleum Company, The Atlantic Refining Company, and Pan-American Refining Corporation in July.)

It is generally believed that the OWIU's loudest request may be for a pay hike ranging up to 15 cents an hour, but few expect it to be pushed if the companies will listen favorably to other demands. As to just what these other demands may be, WORLD OIL found considerable agreement between the industrial relations experts and the union itself.

The Union View. Ray Davidson, publicity director for OWIU, said this: "Our over-all bargaining policy now calls for the securing of wage increases above and beyond those necessary to meet the change in cost of living; the securing of standby 36-hour work week clauses to be applied if and when unemployment becomes a serious problem; the securing of a greater degree of control in company pensions; and better sick leave and sick benefit clauses. All of these things are being sought by the individual bargaining groups acting separately as their contracts come open in the normal course of events."

Davidson added that "The decontrol of wages will have perhaps less startling effect on our union than some others. We are closing out relatively few agreements at this time and therefore would have very few cases to send before WSB. Of course, the end of controls will speed up the putting into effect of such changes as are negotiated by our union, since changes can be made effective im-

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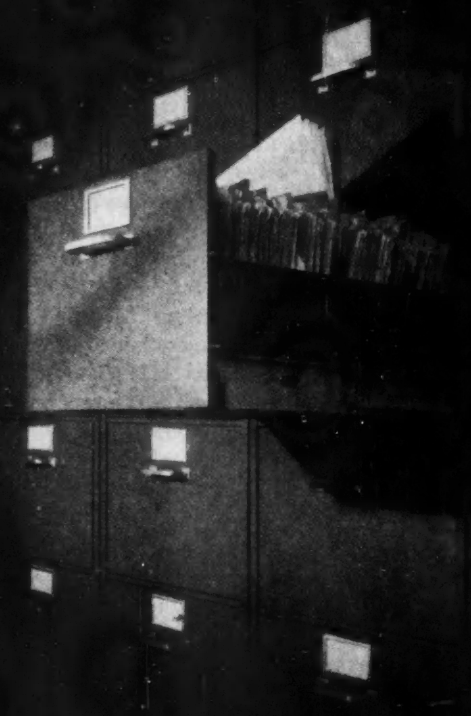

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mediately upon agreement between companies and the union without waiting for WSB approval."

A notable omission from the union spokesman's list of goals is OWIU's long-practiced technique of upgrading workers through insistence on no discrimination as to race, color or creed. Industrial relations men say this upgrading is being aided by the trend to mechanization. For instance, a carload of sulfur that would formerly be unloaded by laborers with shovels might now be emptied by a machine handled by workers of higher classification. But OWIU wants the work to remain in the laborers' classification—heavily Negro in some areas—which would bring increased pay commensurate with increased responsibilities.

Other Points. The union probably will demand:

- More paid holidays. The union now gets seven in some areas, eight in others.
- Certain work should not be let out under contract. This would force the companies to maintain a year-round force large enough to meet periodic workloads requiring more man-hours.

If OWIU can obtain some of these points from a major part of the industry, it will help to cement the loosely-built coalition of OWIU, AFL and independent unions that struck last year. And there can be no doubt the OWIU hopes to perpetuate an arrangement which makes it the spokesman for 250,000 workers, double the membership of OWIU.

IPAA Urges U. S. To Curb Imports

Independent Petroleum Association of America through its import policy committee on March 17 at San Antonio, Texas, released a resolution urging Congress to restrict quarterly imports of crude and products to 10 percent of U. S. domestic demand in like quarter of the previous year. The committee asserted that such restriction is essential to the public interest and the welfare and security of the nation.

"Recent months have brought evidence of the crippling effects of unrestrained imports," the committee declared. "Hope for a voluntary solution of the problem is vanishing," it added.

Tidelands Issue Still Up in the Air

What Congress would do about tidelands legislation remained conjectural in late March. Interior Secretary McKay had urged in committee hearings that Congress should pass legislation promptly giving the states clear title to the submerged lands within their traditional borders. This would be three miles out except in the cases of Texas and the Gulf Coast of Florida. In those cases the states would own lands out three leagues or 10½ miles, as stated in the Texas annexation treaty and the Florida state constitution.

McKay added that the same bill should clearly establish the federal government's title to lands beyond the historic state boundaries and its ownership of oil under those outer lands.

Secretary McKay also emphasized the need for a law encouraging early resumption of tidelands exploration and production. He said the U. S. government should recognize leases already issued by the states on properties in federal waters beyond the state boundaries. He recommended that the Interior Department be made administrator of the federal submerged lands.

Attorney General Brownell was a later witness. He evoked protests from States' Righters. He suggested that states should get development rights and revenues from their submerged lands but not quitclaim title. Instead of a quitclaim bill that would relinquish all federal claims to the states' submerged lands, he recommended a law to grant the states only such power as they need to control those lands and to administer development of oil and other resources in them.

He stated that his suggestion would minimize or eliminate a question raised by some witnesses as to the constitutionality of a quitclaim law. Those witnesses argued that quitclaim legislation could not diminish the nation's sovereign rights to its own property. Brownell apparently would prefer to avoid the raising of this point and the responsibility of defending a quitclaim bill in the courts.

To discourage future litigation, Brownell also suggested that Congress should clearly define "historic state boundaries," and draw lines on a map showing state and federal properties. He said a new law should specify that submerged lands under inland waters, including the Great Lakes, are property of the states and that the U. S. government makes no claim to them. He suggested that the Secretary of Interior be allowed broad discretion in administering U. S. properties beyond state boundaries.

The attorney general advised Congress to declare that the U. S. is reserving its powers to regulate navigation and conduct national defense and international relations even in the state areas.

Allowables Are Cut Again in Texas

Seasonal contraction of oil demand and large imports were important factors in causing a further lowering of crude production allowables in Texas for April. The Texas Railroad Commission reduced allowables for the state by 119,366 barrels daily for April, following the cut of 118,000 daily for March. The new allowables will total 2,921,875 barrels daily.

This is the calendar day average, based on actual production for 19 days in Texas fields generally, 18 for East Texas field, 18 for West Texas fields connected to Phillips Petroleum Company's Goldsmith gasoline plant, 17 for Hawkins field, 16 for Pantax, and 9 for Pickton. In March, Texas fields generally were permitted to produce their allowables 21 days.

At the proration hearing preceding issuance of the April order, the representatives of one major purchasing company declared that current U. S. crude stocks of 272 million barrels were 19 million above a year previously and "wastefully high."

Chairman Ernest O. Thompson of the Texas Railroad Commission stated most of the oil importing companies have complied with the Texas legislature's request that they make public monthly reports on imports. He said this information is essential for commission guidance in determining demand for Texas crude and proportional allowables, although the commission does not have authority over imports. "If the nation needs 6 million barrels daily," explained Thompson, "and they (the importing companies) import 6 million barrels daily, there would be no need for production in America."

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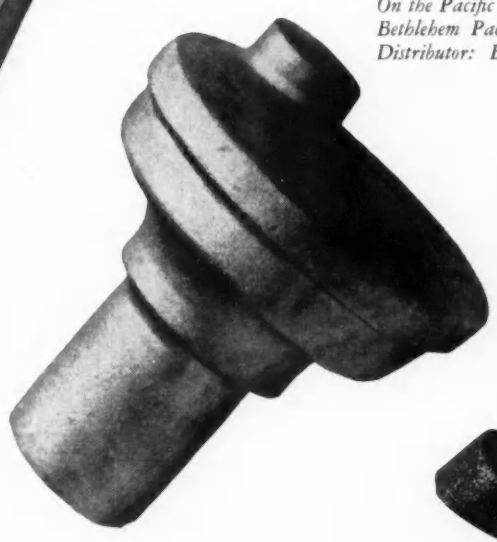

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Drilling Takes Usual Drop, But Completions Still High

DRILLING ACTIVITY dropped in February as is customary, but the decline was not quite as steep as has been the case in recent years. By maintaining this higher level, total wells completed in the year's first two months were boosted to a lead of 5.4 percent over wells drilled in the same period of last year.

February's wells totaling 3527 dropped from January's 3916, but still topped last February's 3280 by 247 wells or 7.5 percent. Combined with January's completed wells they brought the year's total to 7470, which was 364 wells or 5.4 percent higher than last year's 7086.

The amount of footage drilled in those wells has not quite kept pace so far this year. During the initial two months, a total of 30,110,288 feet was represented in the wells completed. A year before the tally had been 29,295,081 feet or only 2.8 percent less. This year each new well completed has been 4054 feet deep on the average, while at the same time in 1952 the average had been 4170.

Although total wells drilled this year has topped last year's by almost 5½ percent, the number completed as producers of oil or gas has not shown a comparable gain. Oil wells totaling 3767, distillate producers numbering 39 and 535 gas wells made up the year's 4341 total producing wells. Those were only about 1½ percent more numerous than last year's 4273 producers. On the other hand, dry holes this year have totaled 2883 and they represent a gain of 12.5 percent over the 2563 recorded last year.

Not included in the above well count—as it was completed in the month of March—was a well of considerable renown. It was a record-breaking well that has become not only the U. S.', but the world's deepest producing well.

Three and one-quarter miles beneath the surface of the marshlands of southern Louisiana, this new producer found oil in commercial quantity to beat the old record-holder by almost 1600 feet. This new deepster, drilled by Shell Oil Company, brought back the world's title to the Weeks Island field of Iberia Parish, Louisiana, where it rested several years ago before California claimed it. Bottom of new pay is 17,122 feet.

Wells Completed in the United States During February, 1953, and First Two Months, 1953

State or District	MONTHLY COMPLETIONS, FEBRUARY, 1953									TOTAL COMPLETIONS				CUMULATIVE TOTALS January-February					Rigs in Operation (Drilling, Rigging Up and Shut Down)		
	NEW WELLS								Total Drilled Deeper												
	Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New		Feb., 1953	Jan., 1953	Feb., 1952	Footage February, 1953	Wells 1953	Wells 1952	Percent Diff.	Footage 1953	Footage 1952	Feb. 28, 1953	Jan. 31, 1953	Feb. 29, 1952
Alabama	4			6				10		10	9	4	48,412	19	7	+171.4	97,896	34,065	6	8	6
Arizona				1				1		1	2		1,105	3			4,927		4	2	2
Arkansas	13		1	15				29		29	46	26	118,861	75	56	+ 33.9	273,959	218,753	30	31	33
California	138		3	45				186	4	190	235	207	871,935	425	416	+ 2.2	1,778,909	1,609,931	245	253	255
Colorado	11		2	27				40		40	47	35	181,011	87	64	+ 35.9	408,791	355,882	31	45	33
Florida				4				4		4	1	1	21,073	5	1	+400.0	25,193	11,794	4	3	
Georgia																			3	2	
Idaho																			1	1	1
Illinois	64			82				146	1	147	202	96	377,926	349	208	+ 67.8	893,023	495,131	137	152	169
Indiana	24		3	44			1	72		72	139	74	131,128	211	193	+ 9.3	381,306	340,756	125	130	144
Kansas	167		27	131			3	328		328	361	307	1,131,035	689	657	+ 4.9	2,402,102	2,292,913	493	460	413
Kentucky	23		16	31	1			71		71	71	79	137,822	142	157	— 9.6	270,564	318,966	55	81	88
Louisiana	95	3	20	67			2	187		187	234	145	1,274,100	421	358	+ 17.6	2,816,926	2,330,740	228	226	238
North Louisiana	50		8	23				81		81	115	74	286,671	196	203	— 3.5	717,252	782,773	46	49	61
South Louisiana	45	3	12	44			2	106		106	119	71	987,429	225	155	+ 45.2	2,099,674	1,547,967	182	177	177
Maryland												4			8	—100.0		32,546	5	5	25
Michigan	9		2	21				32		32	59	47	77,113	91	83	+ 9.6	231,730	227,151	82	80	115
Mississippi	7			18				25		25	39	34	186,780	64	71	— 9.9	469,306	517,314	24	27	27
Missouri				1				1		1	1	2	1,600	2	3	— 33.3	2,186	4,539	2	3	6
Montana	12		2	26				40		40	30	13	171,388	70	25	+180.0	311,185	75,743	56	59	37
Nebraska	6			8				14		14	30	7	80,239	44	29	+ 51.7	230,769	143,817	16	12	14
Nevada				1				1		1			810	1			810		2	1	1
New Mexico	41		33	28	1			103	2	105	151	78	613,799	256	161	+ 59.0	1,462,624	826,397	174	187	169
New York	45				30			75		75	72	63	104,677	147	109	+ 34.9	204,545	153,393	102	106	73
North Dakota	15			8				23		23	14	1	181,916	37	1	+3,600.0	288,502	8,595	23	30	13
Ohio	24		17	24				65	3	68	80	53	138,735	148	120	+ 23.3	319,766	278,972	167	165	144
Oklahoma	331	1	23	159	1		5	520	9	529	511	483	1,873,446	1,040	971	+ 7.1	3,760,100	3,548,331	617	626	608
Oregon																					
Pennsylvania	64		11	3	59			137	1	138	110	113	233,729	248	219	+ 13.2	424,336	383,394	249	228	219
South Dakota																			2	2	2
Tennessee																			2	2	7
Texas	712	10	78	483		1	1	1,285	7	1,292	1,417	1,288	5,832,783	2,709	2,981	— 9.1	12,315,519	14,337,846	1,380	1,352	1,872
Dist. 1 S. Central	24		2	31				57		57	71	62	190,203	128	116	+ 10.3	389,743	345,142	40	49	42
Dist. 2 Middle Gulf	19	1	3	15				38		38	70	64	240,244	108	135	— 20.0	645,652	853,562	53	42	68
Dist. 3 Upper Gulf	62	6	11	44				123	1	124	133	123	824,834	257	302	— 14.9	1,743,646	1,982,618	111	126	162
Dist. 4 L. Gulf-S.W.	82	2	36	57		1	1	179	1	180	165	127	1,015,736	345	280	+ 23.2	1,978,793	1,418,608	113	124	113
Dist. 5 E. Central	9			14				23		23	33	26	103,917	56	66	— 15.2	233,484	341,948	18	22	30
Dist. 6 Northeast	12		8	18				38		38	47	46	212,462	85	96	— 11.5	491,859	6629,062	37	42	50
Dist. 7-B N. Cent.	112		1	109				222		222	267	207	665,182	489	426	+ 14.8	1,528,984	1,347,921	137	130	184
Dist. 7-C W. Cent.	73	1		40				114	2	116	131	133	572,155	247	364	— 32.3	1,211,064	2,146,296	180	151	289
Dist. 8 West	132		1	32				165	3	168	209	224	964,007	377	604	— 37.6	2,108,747	3,409,036	300	298	517
Dist. 9 North	172		2	122				296		296	243	259	946,327	539	517	+ 4.3	1,768,253	1,611,025	321	282	288
Dist. 10 Panhandle	15		14	1				30		30	48	17	97,716	78	75	+ 4.0	215,294	252,628	70	86	129
Utah	1			7				8		8	5	7	45,901	13	9	+ 44.4	74,332	53,569	24	25	28
Virginia																					1
West Virginia	6		34	12				52	1	53	34	65	143,962	87	92	— 5.4	243,563	261,531	196	200	201
Wyoming	28			16				44		44	43	48	212,812	87	87		417,419	433,012	70	81	81
Total U. S.	1,840	14	272	1,268	92	1	12	3,499	28	3,527	3,943	3,280	14,194,098	7,470	7,086	+ 5.4	30,110,288	29,295,081	4,585	4,585	5,025

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Sinews of Industry

The challenge of 1941 is repeated—oil again is affecting the destiny of nations.

By ROBERT G. DUNLOP
President, Sun Oil Company, Philadelphia

"THE OIL INDUSTRY, and your geological profession in its relationship to that industry, are both getting unwonted attention just now because of the supreme importance of oil in a world at war. More than almost any other natural resource, the supply and distribution of oil are at this moment affecting the destiny of nations, the course of history. I think it is not too much to say that our very hopes for the future of civilization largely depend on our success in developing, producing and manufacturing a product that is difficult to find, difficult to produce, and difficult to reduce to its best value for use." These words were spoken by the late J. Edgar Pew 12 years ago. Since then, there has been, fundamentally, such little change in the nature of our problems, that those words of Mr. Pew are as timely today as they were in 1941.

The American people again are concerned about our national safety and the state of our defense preparedness. Through their representatives in Congress, they are again examining our bulwarks for weaknesses which require strengthening. They are turning to the military services, to industry, to agriculture and to the other important segments of our national life and asking:

"Are you ready? Are you prepared to do your part if the calamity of war again should befall us?"

Perhaps you recall these words from St. Luke: "Or what king, going to make war against another king, sitteth not down first, and consulteth whether he be able with ten thousand to meet him that cometh against him with twenty thousand?"

In other words, this searching and questioning and counting of costs among us is a proper and understandable activity. Every society, whether civilized or savage, has done exactly the same thing whenever seriously threatened from the outside. Under the stress of danger, a people consolidate their defenses by demanding of individuals and organizations greater loyalty, greater conformity to the norms of thought and action, and greater willingness to subvert individual interests to the common interest.

This article is taken from a speech delivered by Robert G. Dunlop before a joint session of the AAPG, SEG and SEPM meetings March 24 in Houston.

Ready or not. All of us understand this, almost as if by instinct. It was understood by the two Negro boys I overheard in a railroad station a few weeks ago. They were talking about the possibility of induction into the Army, and one asked the other:

"Are you ready to go?"

"No," said the other, "I ain't ready, but I'm willing to go, unready."

So as an outgrowth of the general anxiety regarding the ability of our nation to meet the challenges of the future, the oil industry again is being asked to give an accounting of itself. Less than a month ago the Senate Interior and Insular Affairs Committee began hearings regarding petroleum production. In recent months, other committees have also investigated certain aspects of our business. One does not have to be very sage to predict that more investigations of the oil industry will be inaugurated in the months immediately ahead.

The response of the industry to this quest for information and assurance will continue to be, I am certain, one of unreserved cooperation. We have shown by past action that we accept the responsibility of telling our story to the public and to its representatives in government in such a way as to inform them accurately regarding our current affairs and our future potential. The end we all seek, of course, is sound public policy, wise in its conception and favorable in its effect.

Now the question is, what precisely is the story we have to tell about our present situation?

First of all, we should make it clear that the American petroleum industry is stronger and more vigorous today in its service to the American people than it has ever before been in its history. It is bigger, also, and that should be a comfort even to those who use the term "big business" as an invective, for the size of American oil companies, in these times of trouble and tension, is a measure of our national security.

Of course, every aspect of our current situation is not as favorable as we might desire. But all things considered, the American petroleum industry is in better shape now than it has ever been. Since World War II we have greatly increased the number, capacities and, perhaps even more important, the technical capabilities of our refineries. I am sure you were gratified as I was last month when Dr. Robert E. Wilson, chairman of the now discharged "Million Barrel" committee, reported that the industry is on the point of attaining its stated objective of increasing its refining capacity by a million barrels a day over the capacity that existed on Jan. 1, 1951. At the same time he said that "our transportation system for oil has never been as fully adequate to do its job as it is today"—another major achievement.

More oil. We have more producing wells at present than ever before. We have, allowing for short term variations, greater actual production. We have greater potential production with existing wells. And we have greater proved reserves of oil and gas in the ground.

Even at that, we have by no means as yet found all the oil that is to be found in this country; neither have we explored all the likely oil territory within our borders.

Alarm has been expressed over the fact that America has become a net

importer rather than exporter of petroleum. Let us hasten to make clear that this does not mean that domestic production has declined. It means rather that oil from foreign sources (developed for the most part by American know-how and ingenuity) has become much more plentiful than it was a few years ago. More about this matter of imports a bit later.

Here the point I want to make is that the American petroleum industry—bigger, stronger and more vigorous than ever before—can report to the American people:

"We have prepared well; you can rely on us."

After we have told this part of the story—and I will not enlarge upon it because I know you are as familiar with its details as I am—then I think we should proceed to give some of the reasons why we are so vigorous and strong. This is exceedingly important, for the continued ability of our industry to serve the American people depends upon the preservation of the climate of freedom and enterprise which made possible our present stature. To my mind there are three major explanations.

The first is the competition factor. Back almost twenty centuries ago, the Latin poet Ovid wrote:

"The valiant horse races best, at the barrier's fall, when he has others to follow and o'erpass." A freer translation: competition makes a horse race. Now I hope no one thinks this an invidious comparison, but competition also makes the oil industry.

Competition keen. In the oil business, competition is the relentless, driving force that keeps each company doing its utmost to take the lead and to hold it. It is the essence of business progress. Nothing is more stimulating or more likely to bring about the long run success of a business enterprise than the existence of other firms striving to produce similar goods and services at lower cost.

I remember visiting our refinery in Toledo a few years ago and talking with a foreman, who told me he was glad we were installing a new, advanced catalytic cracking plant because, he said:

"That means we can keep up with the competition."

"What's your interest in competition?" I asked, not without some satisfaction at his comment. His reply was to the point:

"As long as we can compete, I eat."

Of course, the greatest benefit of competition is the protection it affords the public. A Massachusetts newspaper recently made this point in an editorial, commenting on the unsuccessful move by several leading gasoline marketers to increase the tankwagon price of gasoline in New England areas a few weeks ago. This editorial observed that the companies were forced to return their prices to previous levels because other marketers, appraising the supply-demand situation differently, declined to follow the price move. The editorial concluded by saying:

"Once again the public interest has been protected by competition."

The second reason for our success is the competency factor. The oil industry is made up of unusually competent and skillful people. And the most competent and skillful oilmen in the world, the record clearly shows, are our fellow countrymen. The membership of your own association is conclusive evidence of that. Americans, for example, were the first to discover oil in England and in Hungary. They found the most important field in Germany. American technical skill was largely responsible for the success achieved in developing production in Mexico, Colombia, Venezuela, Iran, Saudi Arabia, Iraq, Burma and Peru. As a matter of fact, Americans were identified with the early development of oil fields in Russia and Roumania. And of course, the biggest and best job of all they have done here in the U. S.

Strength of industry. It is not only in the oil production that the skill and competency of American oil men have outstripped the world. In every other branch of the industry we find men and women equally capable. The strength of the oil industry lies in its people. And the people of this industry build their own security on the solid bedrock of skill and competency.

My own conviction in this regard is deep rooted. As a boy in New Jersey I frequently passed a trade school with these words cut in stone over the entrance—"He who hath a trade, hath an estate." In other words, the very basis for personal opportunity and security is a developed skill or competency, the ability to do, in one's chosen field of endeavor.

These two factors, competition and competency, to my mind are the sinews of our industry or, indeed, of any industry capable of prospering in a free enterprise system. But one further explanation is required to understand the major reasons why the American oil industry has been so successful. That reason lies in the fact that here in America we have had the economic incentives necessary to stimulate both individual and corporate growth.

The existence of economic incentive determines the availability of a natural resource. In fact, the basic concept of a natural resource is the recognition that it is a manifestation of the resourcefulness of a free people. The test of the resource is its economic utility in the satisfaction of the wants and desires of the human race. The great oil reserves of the Middle East were indicated to the peoples of early times, but there was no economic incentive respecting their development and use, hence they were not, as we visualize them today, natural resources.

This idea of availability as dependent upon economic conditions rather than on mere physical existence is fundamental in our domestic industry. We take it into account when we estimate our proved reserves, basing our estimates not on the actual number of barrels we believe to be in the ground, but rather, in the standard phrasing of the API's Committee on Petroleum Reserves, on the "oil and natural gas liquids recoverable under existing economic and operating conditions." Or, to take another example, today there are available in this country several hundred more drilling rigs than present economic incentives can obtain employment for. Not the number of rigs available, but the incentive to employ them is a controlling factor today in determining our rate of drilling.

Price squeeze. The fact is that domestic oil producers currently are facing a decline in economic incentive. They find themselves in a squeeze between rising production costs and an inability to get a higher price for their output. Thus the profit

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margins that provided both the incentive and the wherewithal for drilling activities are being narrowed. Already evidence appears of a slackening in the drilling pace domestic producers set last year.

There is nothing new about recessions in the oil producing business. The history of the industry has been marked by periods of predominant demand with strong prices, alternating with periods of comparatively increasing supplies and weakening prices. As a dynamic industry we have progressed in response to such supply and demand fluctuations of a free market. We never have been "a prince or pauper" industry; but none of us is so naive as to believe that there always can be peaks and never valleys on the chart of our economic activities.

Consequently, if our current difficulties had their source solely in the usual cause of recurrent maladjustments of supply and demand, there would be no reason for any widespread concern. In such circumstances, freely-functioning prices always have provided the solution. But a factor, not until recent months acute, is at the base of our present situation. Even more disturbing is the fear that this factor may continue to have a heavy impact on our production activities for many years to come. I mean, of course, the importation of foreign oil in substantial volume.

Over the postwar years, oil imports have grown from relatively unimportant quantities to a volume averaging in excess of 1,000,000 barrels a day so far this year. In the last two years the volume of imports has steadily increased, out of proportion to the increases in demand in this country. Thus imported oil has been supplanting domestic production, and, to such an extent, that since last December the Texas regulatory authority has found it necessary to reduce allowables to 380,000 barrels a day.

It seems to me that in seeking to meet the obvious problem growing out of these facts, we must necessarily think in terms of both short term and long run solutions. Concededly, lasting solutions seldom can be found to complex problems through short run approaches. But the urgency of the immediate situation is such, as I hope to demonstrate, that it cannot wait for the development of long range planning.

Defense obligations. The short term—the situation as it exists today—must be considered against the background of the industry's obligations and responsibilities to America's national defense requirements. In view of what happened during the last two World Wars, there is no need to labor the point that oil is one of the most essential requirements of modern warfare. Without adequate supplies of petroleum products, no nation at war can hope to be victorious. Therefore, all else must, until our national security is assured, be subordinated to the fulfillment of the oil industry's obligations in this regard.

In our planning to meet these obligations we cannot assume that during a global war we shall have access to the oil resources of other nations, with the exception of Canada. We must base our preparations on the hypothesis that to wage a global war our country must be fully self-sufficient in the matter of oil supplies. To do otherwise would be to trifle with our prospects of survival.

It was precisely for this reason that Petroleum Administration for Defense, in conjunction with the Armed Services, has urged the industry to develop its oil field potentialities to provide an immediate increase, when needed, of some 1,000,000 barrels a day in production. This goal can be achieved only by an expanded drilling program in the absence of the unlikely prospect of a new flush discovery. I have no doubt that the physical capacity is available to do this job. But drilling programs cost money, more today than ever before. Only economic incentives in a free enterprise economy can provide that money.

But when costs go up without compensatory price increases, economic incentives are lessened. They are further weakened by fears of a prolonged continuation of narrowing profit margins. This has been happening as a result of the increasing flow of imports into this country.

During the five years since any marked increase has taken place in the prices of crude oil, its production costs gradually have increased. During the last two years those prices have been frozen by government edict. During those two years we commenced to feel the impact of imports.

Import cut? Now when prices have been freed of government control the domestic producer finds himself facing a wall of mounting imports of oil produced more cheaply than he can now match. What is more, his situation is aggravated by the cutbacks in allowables, thus further increasing his unit costs and narrowing the return on his investment. Continuation for a period of time of this situation inevitably will result in an impairment of both the economic incentive and the source of money needed for the drilling operations essential to effectuating the national defense program for oil producers.

The only meaningful solution to this situation is a decrease in oil imports. It is much better for everyone concerned with this problem if the importing companies voluntarily reduce their imports than if resort is had, as has been proposed, to governmental action through increased tariffs or limiting quotas or some other form of controls. Such a course permits far greater flexibility to adjust the requirements of the situation. Moreover, it does not have the danger of continued government encroachment on the industry's affairs once national defense needs have been satisfied.

None of this is to be taken as any criticism of the operations of American companies abroad, nor are we suggesting that they cease such operations. But it is a plea that they temper their activities in order to promote the country's current national defense goals. None of us has any right to do anything that impedes national defense preparation.

But whatever is done in that respect hardly can be regarded as any lasting solution of the problem of foreign oil. Realistically we must face up to the fact that so long as foreign oil can be produced and delivered here cheaper than domestic oil, we shall have to contend with imports.

That is the long run aspect of this problem. That is the challenge really facing the domestic producer. In the long run it cannot be solved by resort to expediencies or palliatives unless we are going to abandon those com-

■ CONTINUED ON PAGE 60

Workhorse of the Oil Fields

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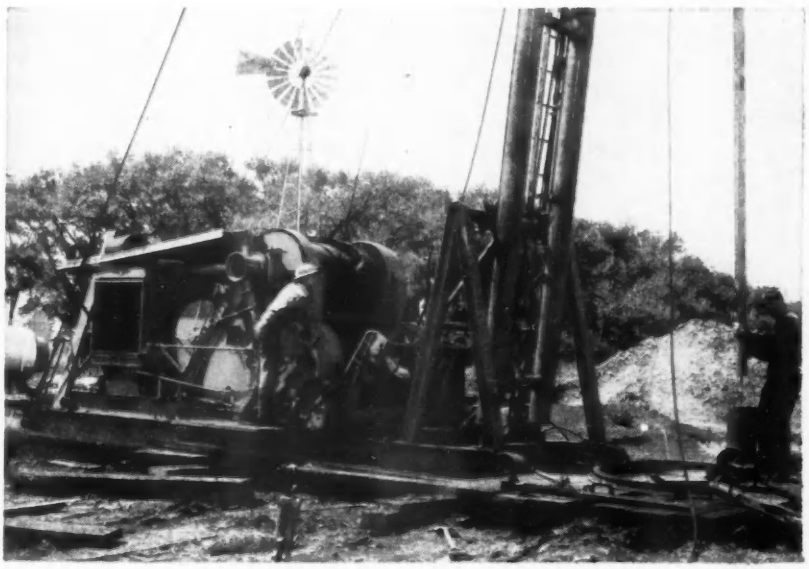
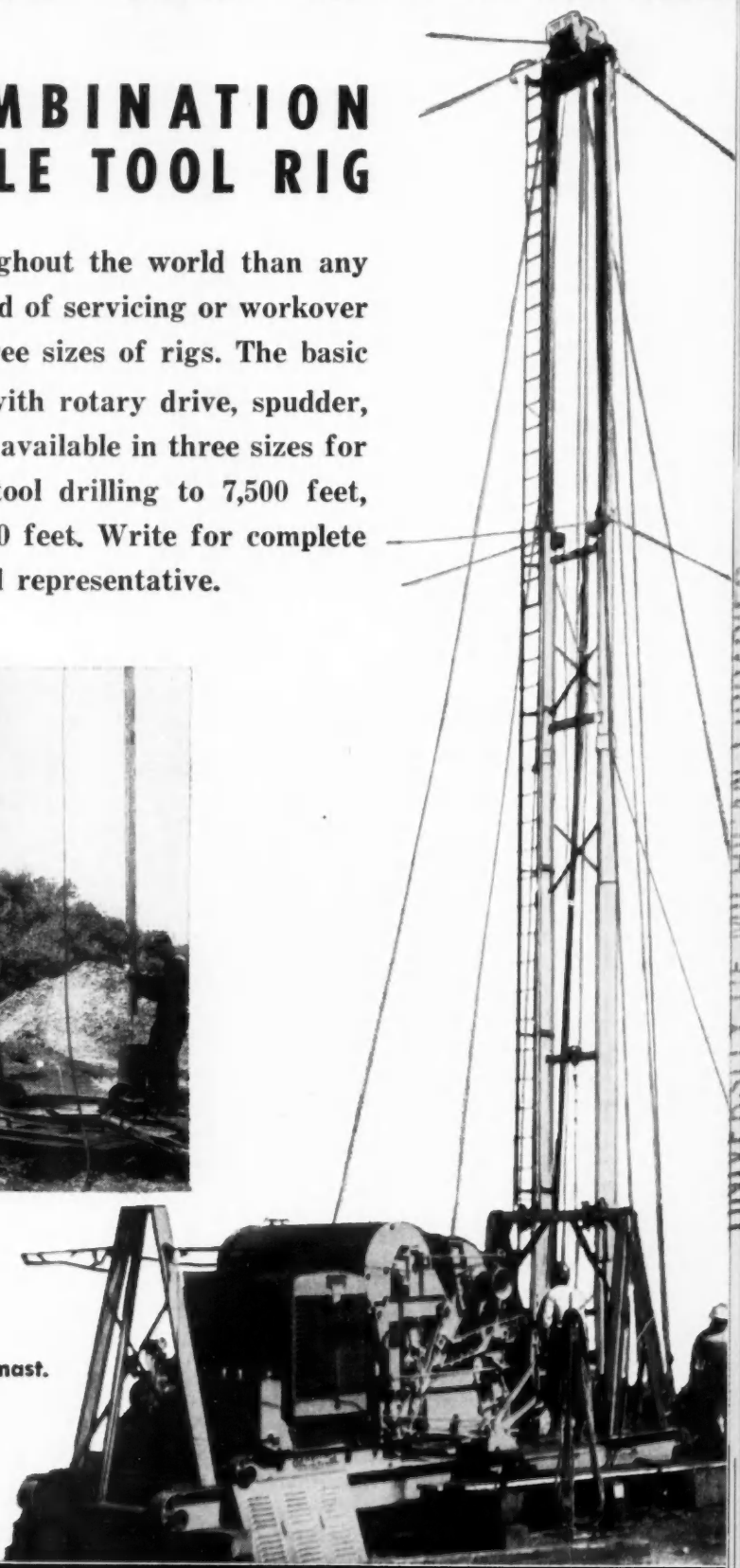


Double drum with spudder on drilling-in job.



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Texas Compensation Insurance Bill Survives Early Attacks

New legislation provides for revised mediation setup, $2000 limitation on attorneys' fees.

RELIEF FROM outmoded workmen's compensation laws and attendant towering insurance rates was nearer for the Texas oil industry last month after House Bill 261 cleared the State Affairs Committee and survived a powerful attack on the floor of the Texas Legislature's House of Representatives.

Proponents of the bill resisted by a vote of 68 to 61 a motion to send it back to the committee for interment and were confident they would beat off another such proposal expected before month's end. The next major hurdle would then be encountered in the Senate, where smoother going was anticipated because of a compromise already effected in the House Committee which answered a major criticism of many Senators.

This compromise maintains the right of appeal to the courts in compensation cases and represents the greatest single deviation from the original purpose of the drilling contractors, who were hardest hit by the recent raise in compensation insurance rates (WORLD OIL, February 1, p. 55). The contractors had proposed that the decisions of the Industrial Accident Board—or its successor—be final except on points of law. However, the compromise was not a complete defeat for the contractors' principles in that it did carry a provision that future findings of the Accident Board would be admissible as evidence in the court of appeals. The old law forbids this, thereby depriving juries of the knowledge and experience of the board.

The bill as reported to the House floor provided that the Industrial Accident Board would be abolished and its records, equipment and three-man membership transferred to a Workmen's Compensation Board. Assisting the new board would be traveling commssioners empowered to hold preliminary hearings in the locale of accident cases. In the event no agreement could be reached, the case would go before the board as a whole, and thence on appeal to the district courts and the Court of Civil Appeals.

Board members' salaries ($10,800) would be paid from the general revenue fund, but salaries of commissioners ($8400) and others would come from a tax on insurance premiums. The effect would be to have the administration supported by the employers who buy insurance rather than by the general public.

A major victory for the 100,000 Texas employers said to be actively favoring the bill was retention in the committee of a sharp limitation on attorneys' fees. It has long been held that the old law encouraged attorneys to appeal every case from the accident board's findings by allowing them up to 33⅓ percent of the court awards in addition to a 10 and 15 percent cut of the board's grants. As originally introduced, the new bill limited attorneys' fees to $1500. The ceiling was upped to $2000 in the committee, which remains as a vast improvement over not-uncommon fees of $5000 or more now being pocketed.

Other major points:

- Removal of employers' liability for employes' accidents in company vehicles when the employes are engaged in personal pursuits.
- Provision for self-insurance. Self-insurance is now possible only through a separate company.
- Elimination of the method of compensation calculation as set up by the Holmes case. (The Holmes decision, handed down in 1946 by the Texas Supreme Court, makes it possible for a highly paid worker to receive as much compensation for a 10 percent leg disability, for example, as for the loss of the entire leg.)
- An increase in maximum weekly benefits from $25 to $30 and an increase in the minimum from $9 to $12.

Sinews of Industry

■ CONTINUED FROM PAGE 56

petitive enterprise principles that have made our industry great.

Aside from the national defense aspects of this matter, it is to be expected, and properly so, that the American companies operating abroad will, in the long run, undertake to make the most of the advantages of foreign oil. Of course, the costs of producing and delivering that oil may increase; or the risks inherent in foreign operations may offset the cost advantages. But it would be imprudent to sit around twittling our thumbs waiting for such eventualities to develop.

Action needed. The sure way to answer price competition is to reduce your own costs and prices. The competitive spirit of the industry will force us to do that and our competence and skill will give us the means. We but need the will to start taking steps in that direction.

I have heard it suggested that it is impossible to reduce the costs of oil exploration and production. No man can say that with any certainty. This industry again and again has reduced the costs of transporting, refining and marketing oil. It has developed methods and efficiencies in those fields that a generation ago were called impossible to achieve. Over the years costs of production also have been lowered. And such is the ingenuity and resourcefulness of you gentlemen and those engaged in production that I am confident that much more can be done in that direction.

Not only is there room for improved equipment and techniques, but the savings in operating costs possible through such arrangements as unitization hardly have begun. Undoubtedly anyone of you upon a little reflection could suggest numerous other approaches to reducing costs.

We should make ourselves strong through efforts to do a better and less costly job, rather than seeking relief under price umbrellas and artificial restraints. The latter provide scant protection when storms commence to blow.

Relying on our historic ability as competitors and upon the competency of the men and women within our ranks, let us face the future with the quiet, unassuming confidence that a proud and well-served nation has come to expect of us.

What Our Readers Say About Middle-East Oil

Here are some reactions to a possible threat to the structure of the industry.

IN THE CURRENT OUTLOOK Section of the Review-Forecast issue of WORLD OIL, published Feb. 15, 1953, Publisher Ray L. Dudley and Staffer Robert E. Spann co-authored the article "Will the Growth of Middle East Oil Revive International Compact Talk?" They posed questions and answers on this possible threat to the structure of the entire industry. Since the problem itself is so great and constructive views so valuable, the authors invited WORLD OIL readers to express their views as to what can or should be done. Here are two such views.

•

In your Current Outlook Section, Feb. 15, 1953, you very kindly invite subscribers to WORLD OIL to present constructive views as to what can or should be done in regard to Middle East oil problems and the Anglo-Iranian-Mossadegh dispute over Persian oil.

To my mind it would be impossible to go into the question of solution of this problem in a communication as the intangibles and the unravelling of them are so many and so astutely woven that a personal talk alone will help in the solution of this grave issue.

I have had a personal experience of Indian and Near East questions over the greater part of a lifetime, and have had the advantage of being the informal adviser of the Government of India (British Period) when Sir Ernest Low, Commerce and Industries Secretary, Government of India, was my immediate superior, and Sir William Vincent and Sir George Barnes (a Labour no-good) were members of the Viceroy's Council, Government of India, Simla, during the period of World War I.

My own Indian regiment operated with Ironside's Flying Column in Persia about the time immediately after the Russian Revolution of 1917, to be correct about 1919-20, and the observations of my brother officers on Persian politics and movements in those days are as significant as today, but they shed a great deal of light on present troubles and ambitions in the Near East and Persia, and the subtleties of Oriental diplomacy which we of the United Nations must be wary against and fight in all its phases of cunning and trickery.

We must *never* trust the Soviets, who are out for world conquest, but we must by our own firmness and diplomacy win over Persia and the Near East to our side as permanent allies.

It would be impossible to discant in a mere article to any practical use on this big question which is very involved and I shall be glad to give what help I can to defeat Soviet intrigue in the Near East and indeed all over the world by a personal talk with the parties in the oil business interested.

You can see the cunning of the Communists in the movements and nefarious tricks of Premier Naguib, the Communist, in Egypt, whose devilry is persistent in trying to edge Britain out of the Suez Canal Zone. The U. N. can defend the canal from the air but what about the short cut route of shipping to Australia and the East, which is what Communist China backed by Russia is aiming for in an air-borne invasion.

I am open to discuss the above problems at any time if required to do so but writing is too labored a method to be sufficiently effective.

Yours faithfully
S. O. Hatton, R.E., B.Sc.,
F.G.S., P. Eng.
Consulting Geologist,
540-12th Avenue West,
Calgary, Alberta

•

You paint a pretty dark picture of possibilities in your article entitled "Will Growth of Middle East Oil Revive International Compact Talk?" in February 15 issue. However, it does seem that the things you fear could happen.

You asked for suggestions:

Since a strong domestic oil industry is necessary to our national defense and since not even with our domestic oil industry could we fight a global war successfully against a strong opponent;

And since the Near East oil reserves would likely be lost to us in case of war with our most probable enemy, Russia;

And since the haul across the Atlantic to our refineries would be a long and dangerous one;

And since in World War II we found we had to depend heavily on Western Hemisphere oil;

And since the nations of the Western Hemisphere, including Canada whose oil production is growing, are bound to us by special ties and treaties;

Why not try to adopt a Western Hemisphere pact based on reciprocal trade treaties and let Near Eastern oil go to its logical market in peace time Europe and possibly Africa?

This would strengthen our industry and strengthen our defenses. It would protect the Western Hemisphere against the possibilities you name—or would it?

Due to my position in a large integrated company, I am asking that you withhold my name and simply call me

"Producer"

politics bOILS

Oil has entered the campaigns for forthcoming Austrian general elections.

Recently, indignation grew in the Lower House when Communist Representative Honner rose to say, "It is good that Austria does not have the power of disposing of its oil deposits, because that would aid the war preparations of the West."

Honner was shouted down and forced to leave Parliament during the session.

Socialist Representative Weihhart replied that Soviets are exporting 60 percent of Austria's oil for their own profit.

And he added: "If we were in the Soviet Union, Honner would not be able to speak any more."

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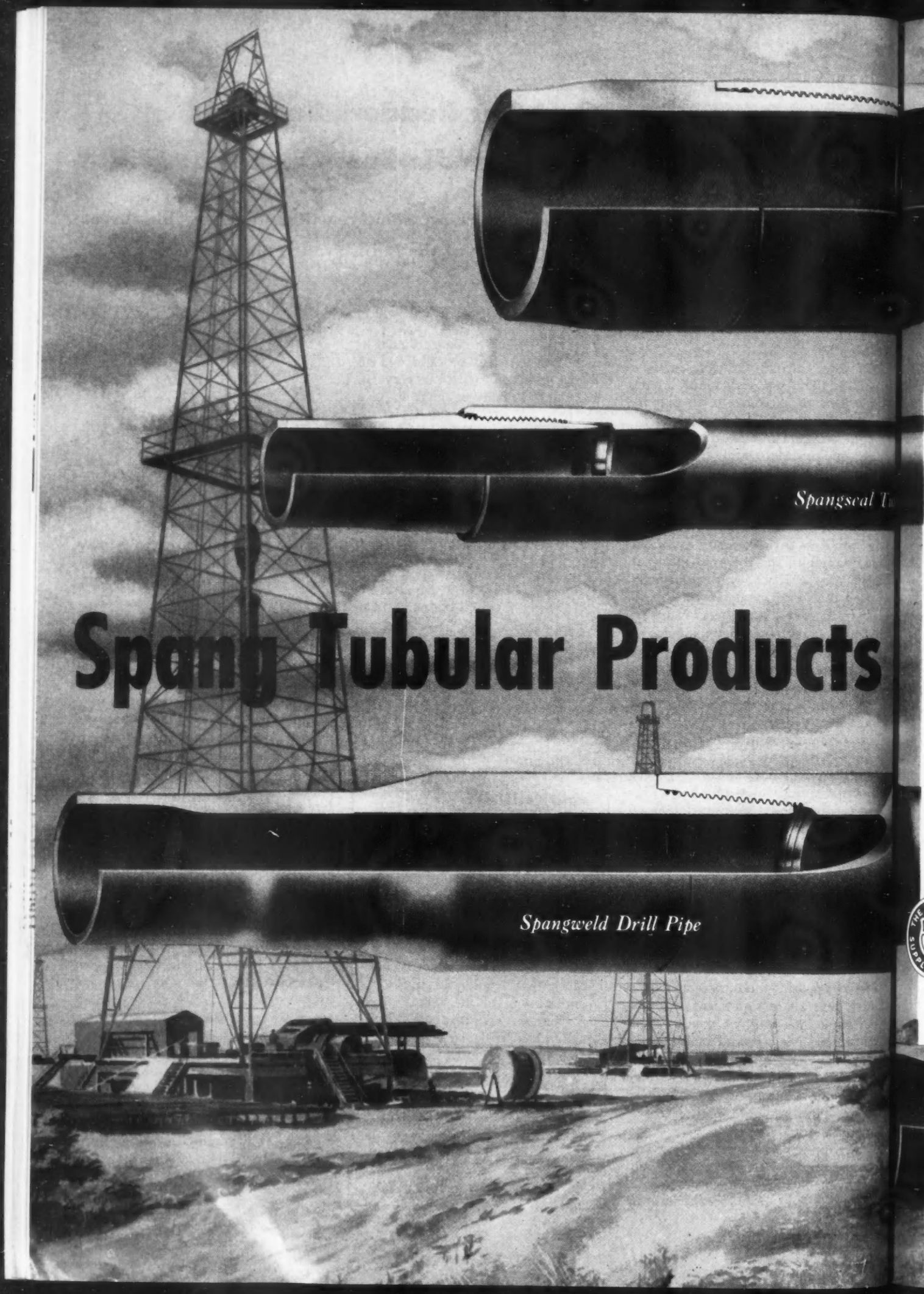

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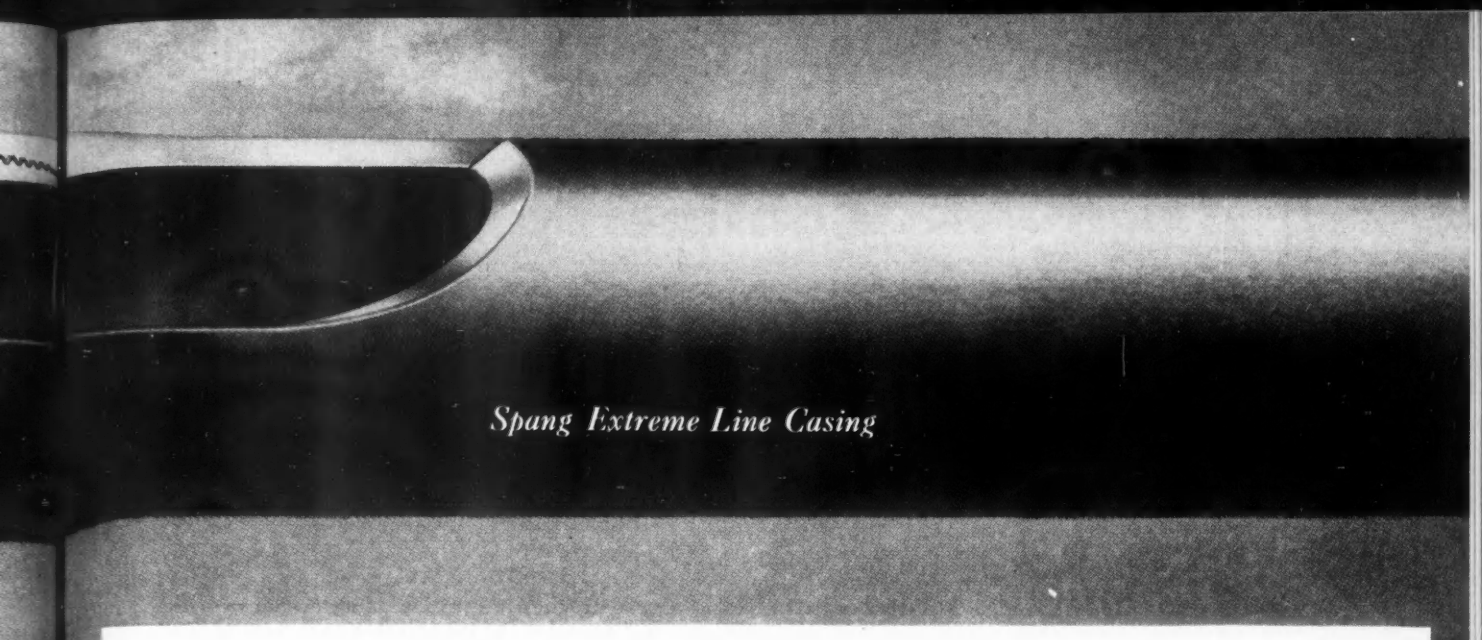

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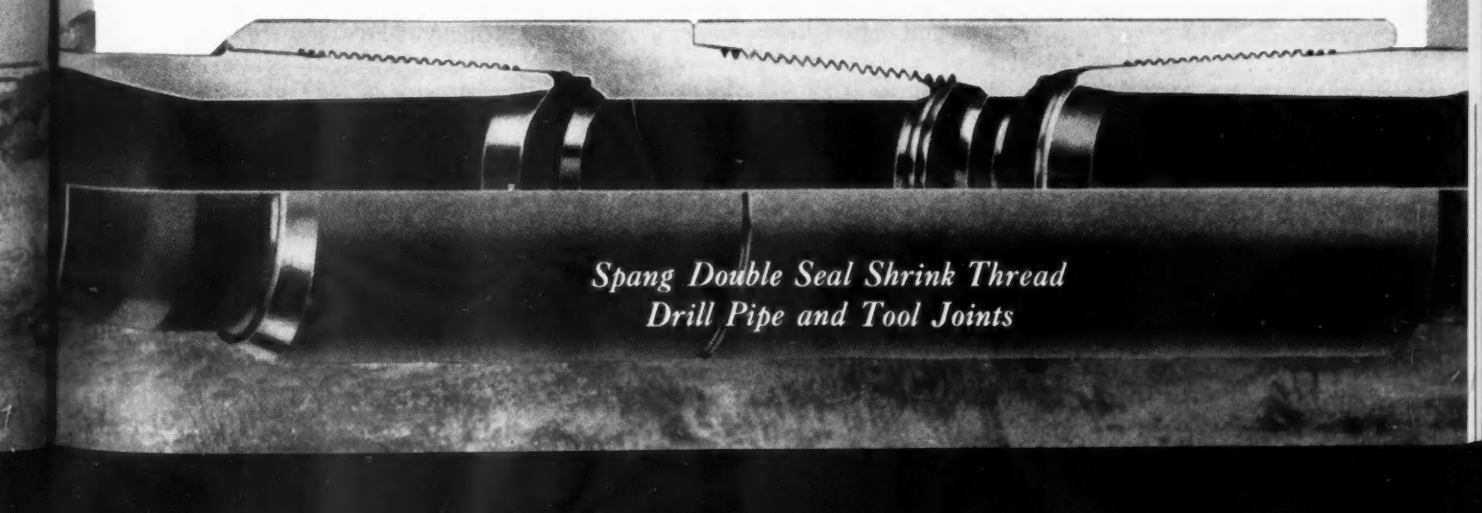


Spang Double Seal Shrink Thread Drill Pipe and Tool Joints

Continental Shelf Could

- **Here's a report from the NPC committee.**
- **200,000 barrels of oil per day possible.**

Western Continental Shelf. Immediately prospective area, 300 square miles to 50-foot water depth along southern coast of California from Point San Luis to Dana Point. Total area, 19,000 square miles to 600-foot water depth.

THE CONTINENTAL SHELF of the U. S. could become within five years the source of the production of 200,000 barrels of petroleum per day and 600 to 800 million cubic feet of natural gas daily. These estimates have been made public recently by the National Petroleum Council's committee on submerged lands productive capacity.

However, a period of five years is inadequate to determine the extent of potential oil and gas supplies of a major new province such as the offshore area, the committee stated. "Exploration and drilling within five years will be more important in locating major oil and gas fields for future development than in providing immediate availability.

"Drilling after the five-year period should increase availability rapidly," stated the committee, "because of additional development on discovered fields, improved techniques, and later discovery and development resulting from continued exploration."

The study was made in compliance with a request of the Oil and Gas Division of the U. S. Department of Interior. The committee was asked to study the problems incident to the discovery, development, and production of offshore petroleum deposits. The request called for an estimate of the availability of production that might be developed from the submerged offshore lands if exploration and development were to be freely conducted over a five-year period, assuming that conditions would exist comparable to those upon which the National Petroleum Council report on productive capacity was based.

The recently submitted report was an interim progress report. The committee explained that it had not completed its studies on the technological aspects of development on the continental shelf. But it stated that "we are now of the opinion that an important number of major oil and gas fields will be discovered within five years," the period designated in the government's request for the study.

As it was requested that the study be made without regard to ownership or title, the committee found it necessary to make certain assumptions. It assumed that existing leases would be confirmed and that additional leases would be granted on basis that would encourage exploration and development.

"Questions of ownership or title and of leasing regulations on any portion of the continental shelf remaining under federal jurisdiction are delaying work in this area," declared the committee. "A prompt, satisfactory solution of these questions must be assumed in answering the inquiry with respect to availability that may be developed within five years."

To its report the committee attached a map of the continental shelf, based on data of the U. S. Geological Survey. (See map.) "The continental shelf is the area extending seaward from the coast which is submerged in less than 600 feet of water," the report explained. "From about the 600 foot water depth, the slope of the ocean bottom usually increases sharply, marking the true edge of the continent. The continental shelf is relatively narrow along the West Coast and wide in the Gulf Coast, reflecting the terrain of the adjacent coasts.

"The continental shelf of the U. S. is estimated to comprise about 278,000 square miles, divided as follows: 132,000 square miles in the Gulf Coast extending from Texas to the tip of Florida. 127,000 square miles off the

Be a Major Source for U. S. Oil

- **600 to 800 mmcf of gas a day foreseen.**
- **These estimates based on five-year period.**

Eastern Seaboard, and 19,000 square miles off the West Coast."

The committee reported that the study was proceeding on the assumptions used by the National Petroleum Council Committee on oil and gas availability in its report of January 1952, which were set forth as follows:

"These estimates assume that there will be no reduction of the incentive to search for and develop new resources, that sufficient steel and manpower will be available, and that the development of the continental shelf will be permitted.

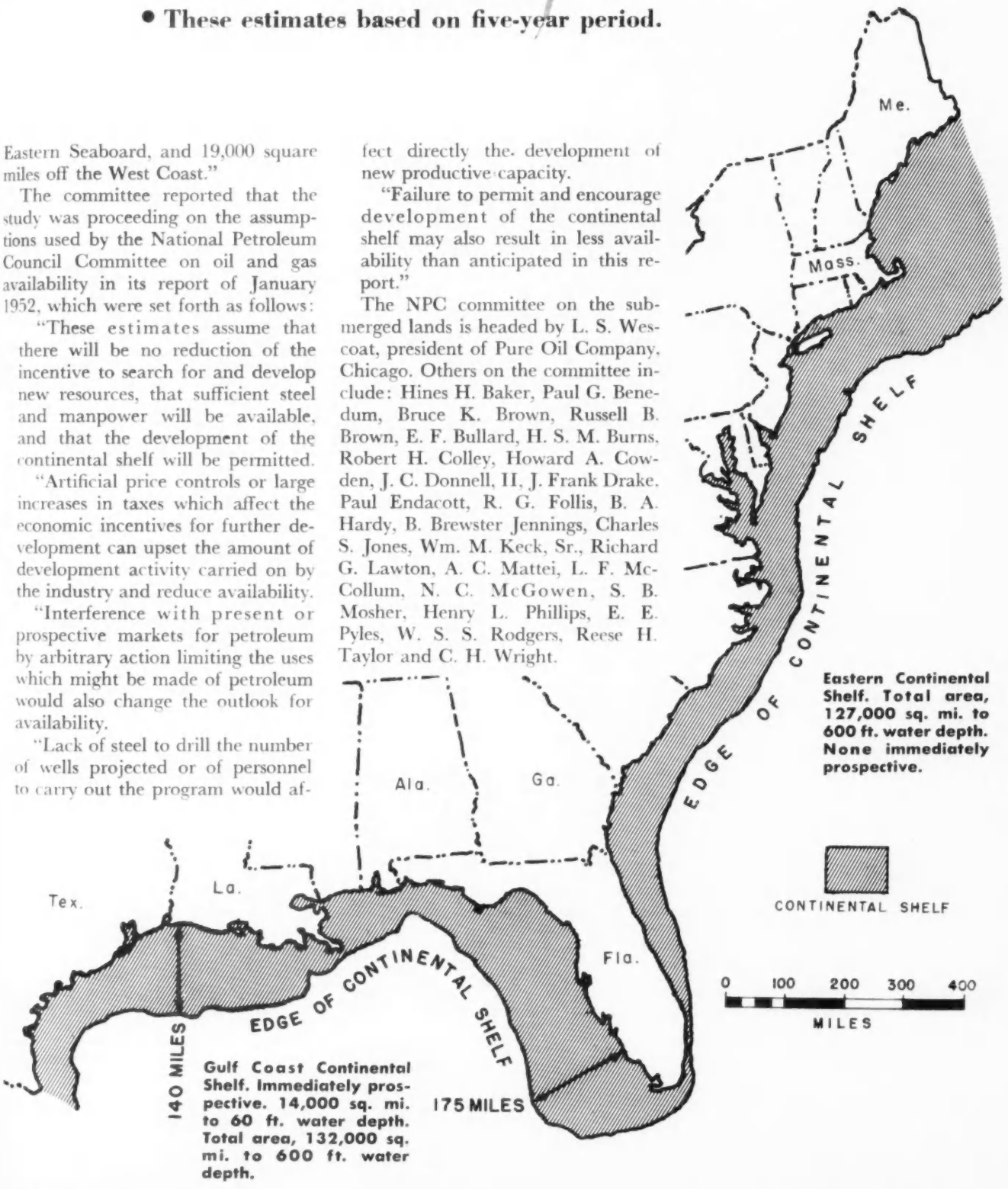
"Artificial price controls or large increases in taxes which affect the economic incentives for further development can upset the amount of development activity carried on by the industry and reduce availability.

"Interference with present or prospective markets for petroleum by arbitrary action limiting the uses which might be made of petroleum would also change the outlook for availability.

"Lack of steel to drill the number of wells projected or of personnel to carry out the program would affect directly the development of new productive capacity.

"Failure to permit and encourage development of the continental shelf may also result in less availability than anticipated in this report."

The NPC committee on the submerged lands is headed by L. S. Wescoat, president of Pure Oil Company, Chicago. Others on the committee include: Hines H. Baker, Paul G. Benedum, Bruce K. Brown, Russell B. Brown, E. F. Bullard, H. S. M. Burns, Robert H. Colley, Howard A. Cowden, J. C. Donnell, II, J. Frank Drake, Paul Endacott, R. G. Follis, B. A. Hardy, B. Brewster Jennings, Charles S. Jones, Wm. M. Keck, Sr., Richard G. Lawton, A. C. Mattei, L. F. McCollum, N. C. McGowen, S. B. Mosher, Henry L. Phillips, E. E. Pyles, W. S. S. Rodgers, Reese H. Taylor and C. H. Wright.


Me.
Mass.
Ala.
Ga.
Fla.
La.
Tex.
EDGE OF CONTINENTAL SHELF
EDGE OF CONTINENTAL SHELF
140 MILES
175 MILES
Eastern Continental Shelf. Total area, 127,000 sq. mi. to 600 ft. water depth. None immediately prospective.
CONTINENTAL SHELF
0 100 200 300 400
MILES
Gulf Coast Continental Shelf. Immediately prospective. 14,000 sq. mi. to 60 ft. water depth. Total area, 132,000 sq. mi. to 600 ft. water depth.

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New Reserves in 1952 Fall Far Short of

- **3,306,126,000 barrels smallest volume proved up since '47.**
- **Total still exceeds production for moderate net increase.**

Estimated Proved U. S. Reserves of Crude Oil, Natural Gas Liquids, and Total Liquid Hydrocarbons, by Years

Sources: Crude Oil by API; Natural Gas Liquids by API and AGA

(THOUSANDS OF BARRELS)

YEAR	NEW OIL ADDED DURING YEAR: Through Revisions of Previous Estimates and Extensions, to Known Fields (1)	Through Discoveries of New Fields and of New Pools in Old Fields (2)	Total Through New Discoveries, Extensions, and Revisions (Columns 1 + 2) (3)	Production During Year (4)	Estimated Proved Reserves as of End of Year (Column 3 - 4) (5)	Increase Over Previous Year (6)
Crude Oil (Incl. Cycle Plant and Lease Condensate)						
1936					13,063,400	
1937	2,792,790	928,742	3,721,532	1,277,664	15,507,268	2,443,868
1938	2,243,571	810,493	3,054,064	1,213,186	17,348,146	1,840,878
1939	2,058,455	340,667	2,399,122	1,264,256	18,483,012	1,134,866
1940	1,607,012	286,338	1,893,350	1,351,847	19,024,515	541,503
1941	1,538,989	429,974	1,968,963	1,404,182	19,589,296	564,781
1942	1,618,925	260,051	1,878,976	1,385,479	20,082,793	493,497
1943	1,202,368	282,418	1,484,786	1,503,427	20,064,152	(—) 18,641
1944	1,556,192	511,308	2,067,500	1,678,421	20,453,231	389,079
1945	1,690,315	419,984	2,110,299	1,736,717	20,826,813	373,582
Crude Oil Only						
1944					19,784,530	
1945					19,941,846	
1946	2,413,628	244,434	2,658,062	1,726,348	20,873,560	931,714
1947	2,019,140	445,430	2,464,570	1,850,445	21,487,685	614,125
1948	3,398,726	396,481	3,795,207	2,002,448	23,280,444	1,792,759
1949	2,297,428	890,417	3,187,845	1,818,800	24,649,489	1,369,045
1950	1,997,769	564,916	2,562,685	1,943,776	25,268,398	618,909
1951	4,024,698	389,256	4,413,954	2,214,321	27,468,031	2,199,633
1952	2,252,860	496,428	2,749,288	2,256,765	27,960,554	492,523
Natural Gas Liquids (Condensate, Natural Gasoline and Liquefied Petroleum Gases)						
1946					3,163,219	
1947	192,237	59,301	251,538	160,782	3,253,975	90,756
1948	405,874	64,683	470,557	183,749	3,540,783	286,808
1949	294,211	92,565	386,776	198,547	3,729,012	188,229
1950	707,879	58,183	766,062	227,411	4,267,663	538,651
1951	648,497	75,494	723,991	267,052	4,724,602	456,939
1952	475,170	81,668	556,838	284,789	4,996,651	272,049
Total Liquid Hydrocarbons (Crude Oil and Natural Gas Liquids)						
1946					24,036,779	
1947	2,211,377	504,731	2,716,108	2,011,227	24,741,660	704,881
1948	3,804,600	461,164	4,265,764	2,186,197	26,821,227	2,079,567
1949	2,591,639	982,982	3,574,621	2,017,347	28,378,501	1,557,274
1950	2,705,648	623,099	3,328,747	2,171,187	29,536,061	1,157,560
1951	4,673,195	464,750	5,137,945	2,481,373	32,192,633	2,656,572
1952	2,728,030	578,096	3,306,126	2,541,554	32,957,205	764,572

Estimated U. S. Reserves of Natural Gas, by Years

Source: American Gas Association

(Millions of Cubic Feet—14.65 psia, at 60 deg. F.)

YEAR	NATURAL GAS ADDED DURING YEAR: Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Total of Discoveries, Revisions and Extensions	Net Change in Storage	Net Production During Year	Estimated Proved Reserves as of End of Year	Increase Over Previous Year
1945						147,789,367	
1946	*	*	17,729,152	*	4,942,617	160,575,901	12,786,535
1947	7,570,654	3,410,170	10,980,824	*	5,629,811	165,926,914	5,351,013
1948	9,769,483	4,129,089	13,898,572	51,482	6,007,628	173,869,340	7,942,426
1949	8,061,429	4,612,870	12,674,299	82,746	6,245,041	180,381,344	6,512,004
1950	9,172,381	2,877,351	12,049,732	54,301	6,892,678	185,592,699	5,211,355
1951	13,013,606	3,039,385	16,052,991	132,751	7,966,941	193,811,500	8,218,801
1952	8,934,470	5,411,043	14,345,513	198,850	8,639,638	199,716,225	5,904,725

* Not estimated.

By L. J. LOGAN

WORLD OIL Staff

RESERVE PROVING in the U. S. in 1952 was the least successful of the past five years, despite a record volume of wildcatting. New reserves of crude oil and natural gas liquids were proved up in the total amount of 3,306,126,000 barrels. That was the smallest volume proved up in any year since 1947. It fell far short of the record setting 5,137,945,000 barrels proved in 1951. The 1952 total included 2,749,288,000 barrels of crude and 556,838,000 barrels of natural gas liquids.

The industry proved up more reserves than it consumed in the form of production in 1952. The amount proved up exceeded production by 764,572,000 barrels. However, this was the smallest net increase in reserves since 1947. It contrasted with the record breaking net gain of 2,656,572,000 barrels in 1951.

By virtue of the ¾ billion barrel net increase in 1952, U. S. proved reserves of crude and natural gas liquids rose to 32,957,205,000 barrels at end of 1952 from 32,192,633,000 at end of 1951.

This moderate increase of 2.4 percent in reserves available was satisfactory from the viewpoint that it was the same as the small, 2.4 percent rise in production for 1952 as compared with 1951. The reserves were increased in proportion to the small rise in production. The reserves at end of 1952 were 12.4 times the annual production of 1952, just as the reserves at end of 1951 had been

1951 Peak

equivalent to 12.4 years of production at the 1951 annual rate.

The reserves of nearly 33 billion barrels at end of 1952 included almost 28 billion of crude and nearly 5 billion of natural gas liquids.

The above figures are from the recently released annual reserves reports of API and AGA. (See tables herewith.)

Natural gas reserves were proved up in the U. S. in 1952 in the amount of 14,345,513,000,000 (14.3 trillion)

Summary of Changes in 1952 in Proved U. S. Reserves of Crude Oil, Natural Gas Liquids, and Total Liquid Hydrocarbons

Source: Crude oil from American Petroleum Institute; natural gas liquids from API and American Gas Association.

(THOUSANDS OF BARRELS)

CRUDE OIL		
Total proved reserves as of Dec. 31, 1951		27,468,031
Revisions of previous estimates	+743,729	
Extensions of old pools	1,509,131	
New reserves discovered in 1952 in new fields and in new pools in old fields	496,428	
Proved reserves added in 1952		2,749,288
Total proved reserves as of Dec. 31, 1951 plus new proved reserves added in 1952		30,217,319
Less production during 1952*		2,256,765
Total proved reserves as of Dec. 31, 1952		27,960,554
Increase in reserves during 1952		492,523
NATURAL GAS LIQUIDS		
Total proved reserves as of Dec. 31, 1951		4,724,602
Revisions of previous estimates and extensions of old pools	+475,170	
New reserves discovered in 1952 in new fields and in new pools in old fields	81,668	
Proved reserves added in 1952		556,838
Total proved reserves as of Dec. 31, 1951 plus new proved reserves added in 1952		5,281,440
Less production during 1952*		284,789
Total proved reserves as of Dec. 31, 1952		4,996,651
Increase in reserves during 1952		272,049
TOTAL LIQUID HYDROCARBONS		
Total proved reserves as of Dec. 31, 1951		32,192,633
Revisions of previous estimates and extensions of old pools	+2,728,030	
New reserves discovered in 1952 in new fields and in new pools in old fields	578,096	
Proved reserves added in 1952		3,306,126
Total proved reserves as of Dec. 31, 1951 plus new proved reserves added in 1952		35,498,759
Less production during 1952*		2,541,554
Total proved reserves as of Dec. 31, 9152		32,957,205
Increase in reserves during 1952		764,572

*The 1952 production figures were complied by the committee and where necessary are based on eleven months actual production with an estimate for December. Any variance between the actual production, as later reported, and the figures used herein will be compensated for through revision when the following year's reserve report is compiled. These revisions have in the past been very small.

Estimated Proved Reserves of Crude Oil, Natural Gas Liquids, and Total Hydrocarbons in U. S., by States, and Western Canada, by Provinces

(Sources: For U. S., crude oil from American Petroleum Institute and natural gas liquids from API and American Gas Ass'n. For Canada, all data via API from Canadian Petroleum Ass'n.)

(THOUSANDS OF BARRELS)

STATE or PROVINCE	Proved Reserves Dec. 31, 1951 (1)	Added in 1952 by Extensions and Revisions (2)	[1]Discovered in 1952 in New Fields and in New Pools in Old Fields (3)	Production During 1952 (4)	Reserves Dec. 31, 1952 (Columns 1 + 2 + 3 Less Column 4) (5)	Net Change in Reserves During 1952 (Column 5 Less Column 1) (6)
UNITED STATES						
Crude Oil						
Alabama	7,860	460	8,400	1,085	15,635	7,775
Arkansas	336,458	41,007	2,340	27,544	352,261	15,803
[2]California	3,760,870	409,209	43,542	359,450	3,854,171	93,301
Colorado	325,178	2,468	8,435	30,390	305,691	(—) 19,487
Illinois	646,335	30,334	3,802	61,010	619,461	(—) 26,874
Indiana	50,667	14,552	2,187	11,871	55,535	4,868
Kansas	791,946	213,246	25,942	114,145	916,989	125,043
Kentucky	58,549	6,999	1,806	11,789	55,565	(—) 2,984
[2]Louisiana	2,284,781	406,553	92,643	226,447	2,557,530	272,749
Michigan	64,113	5,282	1,385	13,369	57,411	(—) 6,702
Mississippi	385,387	3,526	4,408	34,512	358,809	(—) 26,578
Montana	108,418	30,272	27,150	9,659	156,181	47,763
Nebraska	15,918	2,079	6,228	2,389	21,836	5,918
New Mexico	611,640	158,663	22,905	59,850	733,358	121,718
New York	57,061	.....	.....	4,207	52,854	(—) 4,207
North Dakota	4,983	43,200	29,440	1,420	76,203	71,220
Ohio	26,436	4,304	.....	3,350	27,390	954
Oklahoma	1,476,457	241,719	28,342	188,898	1,557,620	81,163
Pennsylvania	95,002	37,859	.....	11,137	121,724	26,722
[2]Texas	15,314,964	440,795	170,016	1,009,607	14,916,168	(—)398,796
Utah	29,683	13,000	1,420	1,704	42,399	12,716
West Virginia	38,762	1,100	.....	2,650	37,212	(—) 1,550
Wyoming	973,440	144,997	16,037	69,752	1,064,722	91,282
[3]Miscellaneous	3,123	1,236	.....	530	3,829	706
Total United States	27,468,031	2,252,860	496,428	2,256,765	27,960,554	492,523
[4]Natural Gas Liquids						
[5]Alabama	.....	.....	.....	.....	.....	.....
Arkansas	51,050	1,013	91	1,283	50,871	(—) 179
[2]California	329,316	21,229	1,475	29,513	322,507	(—) 6,809
Colorado	11,910	(—) 14	.....	557	11,339	(—) 571
Illinois	24,572	(—) 907	9	3,428	20,246	(—) 4,326
Indiana	149	50	7	37	169	20
Kansas	159,569	14,666	260	6,268	168,227	8,658
Kentucky	10,478	311	156	1,787	9,158	(—) 1,320
[2]Louisiana	684,773	48,322	17,991	37,420	713,666	28,893
Michigan	1,009	(—) 439	94	81	583	(—) 426
Mississippi	52,290	998	2,056	4,413	50,931	(—) 1,359
Montana	3,341	.....	.....	212	3,129	(—) 212
Nebraska	2,586	221	85	176	2,716	130
New Mexico	130,619	29,689	1,347	10,112	151,543	20,924
Ohio	1,710	94	11	37	1,778	68
Oklahoma	311,125	(—) 4,717	4,970	26,472	284,906	(—) 26,219
Pennsylvania	2,563	214	107	244	2,640	77
[2]Texas	2,877,341	350,683	52,437	155,370	3,125,091	247,750
Utah	61	.....	.....	4	57	(—) 4
West Virginia	23,921	658	220	5,271	19,528	(—) 4,393
Wyoming	45,886	12,948	350	2,094	57,090	11,204
[6]Miscellaneous	333	151	2	10	476	143
Total United States	4,724,602	475,170	81,668	284,789	4,996,651	272,049
[7]Total Liquid Hydrocarbons						
[8]Alabama	7,860	460	8,400	1,085	15,635	7,775
Arkansas	387,508	42,020	2,431	28,827	403,132	15,624
[2]California	4,090,186	430,438	45,017	388,963	4,176,678	86,492
Colorado	337,088	2,454	8,435	30,947	317,030	(—) 20,058
Illinois	670,907	29,427	3,811	64,438	639,707	(—) 31,200
Indiana	50,816	14,602	2,194	11,908	55,704	4,888
Kansas	951,515	227,912	26,202	120,413	1,085,216	133,701
Kentucky	69,027	7,310	1,962	13,576	64,723	(—) 4,304
[2]Louisiana	2,969,554	454,875	110,634	263,867	3,271,196	301,642
Michigan	65,122	4,843	1,479	13,450	57,994	(—) 7,128
Mississippi	437,677	4,524	6,464	38,925	409,740	(—) 27,937
Montana	111,759	30,272	27,150	9,871	159,310	47,551
Nebraska	18,504	2,300	6,313	2,565	24,552	6,048
New Mexico	742,259	188,352	24,252	69,962	884,901	142,642
[8]New York	57,061	.....	.....	4,207	52,854	(—) 4,207
[8]North Dakota	4,983	43,200	29,440	1,420	76,203	71,220
Ohio	28,146	4,398	11	3,387	29,168	1,022
Oklahoma	1,787,582	237,002	33,312	215,370	1,842,526	54,944
Pennsylvania	97,565	38,073	107	11,381	124,364	26,799
[2]Texas	18,192,305	791,478	222,453	1,164,977	18,041,259	(—)151,046
Utah	29,744	13,000	1,420	1,708	42,456	12,712
West Virginia	62,683	1,758	220	7,921	56,740	(—) 5,943
Wyoming	1,019,326	157,945	16,387	71,846	1,121,812	102,486
[9]Miscellaneous	3,456	1,387	2	540	4,305	849
Total United States	32,192,633	2,728,030	578,096	2,541,554	32,957,205	764,572
WESTERN CANADA						
Crude Oil						
Alberta	1,328,000	57,842	198,914	58,367	1,526,389	198,389
Manitoba	500	.....	1,725	119	2,106	1,606
Saskatchewan	21,000	3,125	101,822	1,700	124,247	103,247
Northwest Territories	27,100	(—) 19	.....	314	26,767	(—) 333
Total Crude Oil	1,376,600	60,948	302,461	60,500	1,679,509	302,909
[10]Natural Gas Liquids	11,348	39,675	14,970	619	65,374	54,026
Total Liquid Hydrocarbons	1,387,948	100,623	317,431	61,119	1,744,883	356,935

[1] Limited area assigned to a discovery until proved larger. [2] Includes off-shore reserves. [3] Fla., Mo., Tenn., Va. [4] Condensate, natural gasoline, LPG. [5] Incl. in Miscl. [6] Ala., Fla., N. Dak. [7] Crude oil and natural gas liquids. [8] Crude oil only. [9] Ala. and N. Dak. natural gas liquids; Mo., Tenn., and Va. crude; Fla. crude and natural gas liquids. [10] All in Alta.

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cubic feet. That was the third best year on record, exceeded by the 16.1 trillion proved in 1951 and the 17.7 trillion of 1946.

The 14.3 trillion cubic feet of gas reserves proved up in 1952 well exceeded the 8.6 trillion feet of net production. Consequently, there was a net increase of 5.9 trillion feet in available reserves. The proved reserves rose to a new peak of 199,716,225,000,000 (nearly 200 trillion) cubic feet at end of 1952 from 193.8 trillion at end of 1951. The new total was equivalent to 23.1 years of production at the annual rate recorded for 1952. The reserves at end of 1951 had been equivalent to 24.3 years' production at the 1951 rate.

Reserves of crude oil and natural gas liquids were proved up in 1952 in Western Canada to the extent of 418,054,000 barrels. That amount exceeded the year's production of 61,119,000 barrels by 356,935,000 barrels. This net increase in reserves put the total at end of 1952 at 1,744,883,000 barrels. That total included 1,679,509,000 barrels of crude oil and 65,374,000 barrels of natural gas liquids. These figures on Western Canadian reserves were reported by API along with U. S. data. They were compiled by the reserves committee of the Canadian Petroleum Association.

Estimated Proved Recoverable Reserves of Natural Gas Liquids in U. S., by States

(Includes Condensate, Natural Gasoline, and Liquefied Petroleum Gas)
Sources: American Gas Association and American Petroleum Institute
(Thousands of Barrels of 42 U. S. Gallons)

	Reserves as of Dec. 31, 1950	CHANGES IN RESERVES DURING 1952			RESERVES AS OF DECEMBER 31, 1952			
		Extensions and Revisions	Discoveries of New Fields and New Pools in Old Fields	Net Production§	Total (Columns 6 + 7 + 8, also Columns 1 + 2 + 3 Less Column 4)	Non-Associated	Associated	Dissolved
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Arkansas	51,050	1,013	91	1,283	50,871	29,914	6,762	14,195
*California	329,316	21,229	1,475	29,513	322,507	0	108,720	213,787
Colorado	11,910	(—) 14	0	557	11,339	299	0	11,040
Illinois	24,572	(—) 907	9	3,428	20,246	21	25	20,200
Indiana	149	50	7	37	169	18	15	136
Kansas	159,569	14,666	260	6,268	168,227	163,505	1,513	3,209
Kentucky	10,478	311	156	1,787	9,158	9,158‡	0	0
*Louisiana	684,773	48,322	17,991	37,420	713,666	567,311	98,413	47,942
Michigan	1,009	(—) 439	94	81	583	196	0	387
Mississippi	52,290	998	2,056	4,413	50,931	22,445	23,779	4,707
Montana	3,341	0	0	212	3,129	3,129	0	0
Nebraska	2,586	221	85	176	2,716	2,194	415	107
New Mexico	130,619	29,689	1,347	10,112	151,543	59,636	31,127	60,780
Ohio	1,710	94	11	37	1,778	1,778‡	0	0
Oklahoma	311,125	(—) 4,717	4,970	26,472	284,906	100,438	22,224	162,244
Pennsylvania	2,563	214	107	244	2,640	2,640‡	0	0
*Texas	2,877,341	350,683	52,437	155,370	3,125,091	1,390,472	459,347	1,275,272
Utah	61	0	0	4	57	57	0	0
West Virginia	23,921	658	220	5,271	19,528	19,528	0	0
Wyoming	45,886	12,948	350	2,094	57,090	38,757	18,333	0
†Miscellaneous	333	151	2	10	476	0	0	476
TOTAL	4,724,602	475,170	81,668	284,789	4,996,651	2,411,496	770,673	1,814,482

* Includes off-shore reserves. † Includes Alabama, Florida and North Dakota. ‡ Not allocated by types but occurring principally in the column shown. § Production is credited to state containing reserve when recovery is made in other states.

Summary of Changes in 1952 in Proved U. S. Reserves of Natural Gas

Source: American Gas Association
(Millions of Cubic Feet)

Total proved reserves as of Dec. 31, 1951		193,811,500
Extensions and revisions of previous est.	8,934,470	
New reserves discovered in 1952	5,411,043	
Net changes in "stored gas" during 1952	198,850	
Total proved reserves added and net changes in "stored gas" during 1952		14,544,363
Total proved reserves as of Dec. 31, 1951 and additions during 1952		208,355,863
Deduct production during 1952		8,639,638
Total proved reserves as of Dec. 31, 1952		199,716,225
Increase in reserves during 1952		5,904,725

Estimated Proved Recoverable Reserves of Natural Gas in the United States, By States

Source: American Gas Association
(Millions of Cubic Feet—14.65 psia, at 60 Deg. F)

	Reserves as of Dec. 31, 1951	CHANGES IN RESERVES DURING 1952				RESERVES AS OF DECEMBER 31, 1952$				
		Extensions and Revisions[b]	Discoveries of New Fields and New Pools in Old Fields[b]	Net Change in Underground Storage[c]	Net Production[d]	Total (Columns 7 + 8 + 9 + 10, Also Columns 1 + 2 + 3 + 4 Less Column 5)	Non-Associated[e]	Associated[f]	Dissolved[g]	Underground Storage[h]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Arkansas	931,314	91,070	3,020	630	41,452	984,582	528,029	138,462	315,465	2,626
[i]California	9,482,445	269,427	65,938	(—) 1,925	475,863	9,340,022	2,516,241	2,156,918	4,653,946	12,917
Colorado	1,138,451	31,851	42,181	0	48,234	1,164,249	524,113	39,286	600,850	0
Illinois	227,133	14,750	1,768	0	32,000	211,651	4,251	5,000	202,400	0
Indiana	30,807	9,990	1,472	1,790	7,345	36,714	3,552	3,100	27,225	2,837
Kansas	13,457,498	1,167,567	21,912	1,110	454,522	14,193,565	13,707,255	132,627	320,946	32,737
Kentucky	1,325,588	46,696	11,360	2,379	72,500	1,313,523	1,240,879	0	59,080	13,564
[i]Louisiana	29,005,031	2,176,296	1,540,159	0	1,269,872	31,451,614	25,000,197	4,185,548	2,265,869	0
Michigan	203,025	3,296	18,612	40,498	10,888	254,543	132,752	0	38,645	83,146
Mississippi	2,439,969	21,771	118,224	417	216,321	2,364,060	1,700,671	401,453	261,479	457
Montana	828,107	12,885	17,236	2,051	32,676	827,603	697,705	36,593	83,691	9,614
Nebraska	95,810	1,264	3,964	0	7,080	93,958	64,895	7,701	21,362	0
New Mexico	11,589,979	2,669,335	217,160	4,458	442,043	14,038,889	10,653,682	2,155,593	1,209,904	19,710
New York	66,793	200	0	5,047	3,400	68,640	47,502	0	468	20,670
Ohio	689,135	32,607	8,275	33,966	32,500	731,483	561,537	0	31,470	138,476
Oklahoma	11,804,337	547,606	199,997	13,781	800,892	11,764,829	7,273,114	951,250	3,491,935	48,530
Pennsylvania	619,455	36,595	91,950	56,385	94,800	709,585	515,866	0	36,470	157,249
[i]Texas	105,653,229	1,459,565	2,950,264	13	4,330,308	105,732,763	69,209,845	20,462,637	16,058,448	1,833
Utah	95,845	188,045	2,802	0	3,280	283,412	265,105	0	18,307	0
West Virginia	1,671,499	108,315	23,400	26,256	169,400	1,660,070	1,470,546	0	73,285	116,239
Wyoming	2,340,298	35,660	21,379	11,994	88,207	2,321,124	1,455,746	350,249	502,443	12,686
[a]Miscellaneous	115,752	9,679	49,970	0	6,055	169,346	66,682	0	102,664	0
TOTAL	193,811,500	8,934,470	5,411,043	198,850	8,639,638	199,716,225	137,640,165	31,026,417	30,376,352	673,291

[a] Includes Alabama, Florida, Maryland, Missouri, North Dakota and Virginia. [b] Excludes gas loss due to natural gas liquids recovery. [c] The net difference between gas stored in and gas withdrawn from underground storage reservoirs, inclusive of adjustments. [d] Net production equals gross withdrawals less gas injected into underground reservoirs. Changes in underground storage and gas loss due to natural gas liquids recovery are excluded. December production estimated occasionally. [e] Non-associated gas is free gas not in contact with crude oil in the reservoirs. [f] Associated gas is free gas in contact with crude oil in the reservoirs. [g] Dissolved gas is gas in solution with crude oil in the reservoirs. [h] Net gas placed in underground reservoirs for storage purposes only. [i] Includes off-shore reserves.

Are We Using Our Freedoms?

By CURTIS H. JOHNSON, General Petroleum Corporation, Los Angeles
Past President, Society of Exploration Geophysicists

RECENT NATIONAL and international political events have focussed our attention on our freedoms. The probable removal of many governmental restrictions implies that domestically an era of especially free economy is about to begin. Even behind the iron curtain there is the possibility of a change for the first time in several decades.

In our part of the world we have inherited a free society in which to do our work. Freedom to think and say what we please—to freely exchange ideas. Freedom to come and go—to let our search for oil carry us where it will. Freedom to direct or expand our investigations along paths of our choosing. We have the immeasurable benefit of working under a system of free enterprise and free industrial expansion based on a free market.

• • •

WE DARE NOT take all this freedom for granted. It is a precious thing which must be tended carefully to live. Our preoccupation with our science—with oil-finding itself—must not prevent our participation as good citizens in every activity which will keep us in the light of freedom.

Are we truly using our freedom to its full extent in our oil-finding efforts? Are we taking full advantage of the unlimited scope of action and thought our freedom allows?

Every so often it pays any man or group of men to roll up their sleeves, hitch up their suspenders and dig in for a new start. Oil-finders—geologists, geophysicists and paleontologists—are no exception. The very fact that we are continuing to find oil in adequate quantities as we have in the past may tend to make us complacent; make us content with the same old rut.

As oil-finders we are more fortunate than we realize. Rarely do we stop to think that not only do we live in a free society as a whole, but that most of our employers or clients offer us complete freedom to exercise our imagination and perform with originality in the finding of oil.

• • •

DECENTRALIZATION, DELEGATION of responsibility and removal of hampering restrictions are the new watchwords of the modern oil industry. We, as front-line shock-troops in the oil-finding campaign, must catch this spirit—take advantage of these favorable working conditions.

The techniques, the types of thinking which have found us so many anticlinal oil fields must not dominate our current effort. The relative ease with which we have found oil in the past must not set the tempo for our present activity. Each man of us must tear off the inhibitions and habits of the past and free his latent abilities.

The freedom we enjoy is more than the heritage of our society. It is more than the enlightenment of our industry. It is, in the final analysis, in our individual attitudes and thinking that our true potentialities for freedom exist. Let us utilize our God-given individual freedom of original thinking; throw off our self-imposed shackles; and find oil as (and where) we've never found it before.

The Petroleum Geologist

By MORGAN J. DAVIS, Humble Oil & Refining Company, Houston
Past President, American Association of Petroleum Geologists

TO FIND ENOUGH oil and gas from year to year to assure the industry and the nation of an adequate supply of gasoline and other fuels is the formidable task of the petroleum geologist. In fulfilling this assignment, he is called upon to direct the far-flung exploration activities of the present day search for petroleum. He also must keep the industry posted as to the future possibilities of finding new reserves which can be competitive with other fuels and in addition provide the geological information required to insure maximum recoveries from known accumulations.

It is noteworthy that as the geologist has continued to gather and integrate facts, his viewpoint on the abundance of oil and gas has become more and more optimistic. He now sees little chance that the supply of petroleum in the U. S., or the world, will be depleted in the foreseeable future. For some years he has disagreed with pessimistic outcries which have stemmed from those who deal principally with the statistics of production and proved reserves, those who do not know, or have not properly considered that the widespread occurrence of oil in sedimentary rocks is the rule and not the exception. Discoveries and additions to reserves for the past decade of unprecedented U. S. production support the better informed viewpoint of the petroleum geologist.

• • •

IT WAS NOT until about 1913 that geology was generally applied to oil-finding activities. Since that time the expansion of the industry has been tremendous and each of its various phases has grown proportionately. As the understanding of the way in which oil occurs has improved, the petroleum geologist has been able to apply effectively the basic stratigraphic and structural principles long taught by the academic geologists. He has also devised new techniques, such as thickness and facies mapping, which have been valuable in the interpretation of both local and regional geology.

As knowledge grew, the demand for more critical subsurface data resulted in the development and application of electrical logging instruments and of other tools, such as the dipmeter and sidewall coring devices. The early recognition by the geologist of the oil potentialities of areas where ordinary surface geologic techniques could not be used was largely responsible for the application of geophysics to oil finding, and for the industry's continuing effort to improve the geophysical techniques and instruments which play such a prominent part in present day exploration.

• • •

NO RADICALLY NEW exploration tool has appeared recently and industry continues to base its oil-finding effort almost entirely upon the various time-tried geological and geophysical methods. Since full reliance cannot be placed on any one of these methods in most areas, all have become established parts of exploration operations and are used in conjunction when necessary. Each method provides important information and in many areas the coordination of the results of all of them affords industry with its surest means for finding oil. Such coordination cannot be effected properly without full cooperation of the entire exploration group, which includes physicists, mathematicians, chemists and engineers, as well as geologists. Thus, teamwork is becoming increasingly essential and the petroleum geologist, with his background knowledge of stratigraphy and structure, and of the earth factors which may influence geophysical interpretations, occupies a key position on the exploration team.

Along with this principal task of finding oil, fortunately the petroleum geologist has found other ways of serving the industry and the community. Because of his direct contact with many people in exploratory activities, the

(Continued on Page 88)

Foraminifera—an Evaluation

By CLIFFORD C. CHURCH, Tide Water Associated Oil Company, San Francisco
Past President, Society of Economic Paleontologists and Mineralogists

TO MOST READERS, outside of the relatively few paleontologists and geologists, the reference to foraminifera or micro-fossils has very little meaning. But within the past 30 years the science has so paced the growing oil industry that those familiar with the subject can hardly mention one without calling to mind the other. This science of the micro-fossils, with its few thousand workers, is not new. It actually had its beginning over 100 years ago, at about the time the first crude microscopes were invented, but its greatest impetus came with the improved microscope and the theory of evolution.

The men who pursue this highly specialized branch of geology are called "bug-men" in their practical everyday work. The fossils themselves are referred to as "bugs," a general term which has come to mean any small fossil found in the rock. The practical application of the foraminifera developed rather gradually from the early 1900's up to 1920 at about which time the recognition of their value to the oil industry resulted in the establishment of the first few oil company paleo-laboratories in Houston, Dallas and elsewhere.

• • •

WITHIN THE PAST few years the methods used in the search for oil have changed primarily from those based on indications gained from surface geology to those of a subsurface evaluation by means of seismograph data, well logs, isopach mapping, reef study, stratigraphic traps and facies changes. In such surveys the foraminifera are the age and facies indicators. In the past, as today, they were living under all phases of ocean environment. There were those living in the brackish waters of bays, the shallow littoral zones, the deeper continental shelves and finally the ocean deeps. Most of them lived on the bottom, free moving or attached, but a great many from the Cretaceous period on were free floating (planktonic) forms, following the ocean currents without regard for depths; sensitive only to changes in temperature.

Where the seas went they followed and thus left their traces in the sediments over the world to mark the paths and highways of the ancient seas. From this fact the pelagic species found in the rocks are similar over a great part of the world for the periods in which they lived. They are thus the ideal geological time indicators and excellent in long range correlation. The benthotic species on the other hand vary widely in genera and species depending on their environment. Some will indicate deep or shallow water conditions of the open ocean, others will show the restricting milieu' of shallow inclosed bays. A mixing of pelagic and benthotic species may suggest a shoaling condition in the open sea. A careful analysis of these various factors may understandably lead to a better ecologic interpretation of rock units involved.

• • •

THE MEN WHO WORK at identifying the different fossil species must spend years in careful study and comparison. They are highly trained specialists and the preparation of samples for study involves many techniques, all of which have grown out of the multiple needs of the industry in the expanding complexity of its search for oil.

From its beginning the men in the oil industry have combined a mixture of the adventurer and the businessman. The new business had few limiting traditions so the oil man was free to try each new promising tool. When micro-paleontology was first tried out in the industry there was plenty of skepticism, but the oil men were willing to give it a fair trial.

When its value was proved it was accepted like the many other advances which have made the difference between the 3000-foot well of a few years ago and the 20,000-foot hole of today, and the difference between a few thousand barrels of oil per day a few years ago and the several millions produced today.

ROY L. LAY
SEG President

HAROLD N. FISK
SEPM President

JOHN EMERY ADAMS
AAPG President

Exploration Societies Look to Future

Accomplishments reviewed, achievements recognized, officers elected at annual joint meeting of AAPG, SEPM, SEG in Houston.

A SWEEPING REVIEW of recent developments and a penetrating look at the future of oil exploration were accomplished at the annual joint meeting of the American Association of Petroleum Geologists, the Society of Exploration Geophysicists, and the Society of Economic Paleontologists and Mineralogists March 23-26 in Houston.

The approximately 6000 present also elected new officers and recognized some outstanding achievements in their respective fields.

• The new officers for 1953:

AAPG—President, John Emery Adams, Standard Oil Company of Texas, Midland; vice president, Leslie M. Clark, Pacific Petroleums, Ltd., Calgary, Alberta, Canada; secretary-treasurer, Elliott H. Powers, Southern Production Company, Fort Worth; editor, Armand J. Eardley, University of Utah, Salt Lake City.

SEG—President, Roy L. Lay, The Texas Company, Houston; vice president, Karl Dyk, Stanolind Oil & Gas Company, Tulsa; secretary-treasurer, Bart W. Sorge, United Geophysical Company, Pasadena, Calif.; editor, Milton B. Dobrin, Magnolia Petroleum Company, Dallas.

SEPM—President, Harold N. Fisk, Humble Oil & Refining Company, Houston; secretary-treasurer, Samuel P. Ellison, University of Texas, Austin.

• Those honored:

To Theodor Krey, Seismos GMBH, Hannover-Kirchrode, Germany, for his paper, "The Significance of Diffraction in the Investigation of Faults," the SEG Best Paper Award for 1952;

To Donald Towse, University of North Dakota, Grand Forks, for his paper, "The Frontier Formation, Southwest Powder Basin, Wyoming," the AAPG President's Award:

To Harry R. Johnson, consulting geologist, Los Angeles, and Alexander Deussen, consulting geologist, Houston, AAPG honorary memberships;

To Frederic H. Lahee, Sun Oil Company, Dallas, the AAPG Sidney Powers Memorial Award.

Many Activities. Nearly 80 papers of widely diversified interest were presented during the five-day meeting, which required the facilities of two hotels as headquarters and the Sam Houston Coliseum. Three joint sessions, committee meetings, and the largest exhibit in the history of the annual joint meetings occupied the delegates. Entertainment included a get-acquainted party, cocktail party, dance and breakfast; and for the women guests, a luncheon and style show. Five field trips were made to petrochemical industries, a refinery, natural gasoline plant, sulfur operations, oil fields, a salt mine, and to stratigraphic and structural features representative of Gulf Coast geology. On the latter trip the campuses of the University of Texas and Texas A. and M. College were visited and Dr. Fred M. Bullard of the former institution gave an illustrated lecture

From left:

KARL DYK
SEG Vice President

ELLIOTT H. POWERS
AAPG Secretary-Treasurer

LESLIE M. CLARK
AAPG Vice President

on "A Volcanic Cycle as Exhibited by Italian Volcanoes." There were also local trips to geophysical and research laboratories, equipment plants, Rice Institute, and the University of Houston.

The new presidents bring to their positions a background of distinguished service to industry:

John Emery Adams, 37th president of the AAPG, is an Iowan who served in the Army, took an M.A. degree in geology from the University of Iowa, and entered the industry in 1923 on an Oklahoma survey party of Roxana Petroleum Corporation. During the next three years he continued graduate work at the University of Chicago and the University of Wisconsin, and then was instructor at Texas A. and M. College. After service with the staff of the Texas Bureau of Economic Geology, he became a subsurface geologist and stratigrapher with The California Company. He shifted to Standard Oil Company of Texas in 1937 and served as paleontologist, district geologist, development geologist, field geologist and senior geologist in Texas, Louisiana, and New Mexico. Since 1947, he has also acted as exploration consultant for California Research Corporation.

Adams has been active in the affairs of the AAPG, which he served as vice president in 1950-51. During 1939-42 he was a member of the association's geologic names and correlations committee. In 1944, he made a distinguished lecture tour for the association. In 1945, he was an AAPG research committee consultant, and during 1950-51 served on the business committee. He is now a member of the advisory committee on radioactive mineral exploration.

Adams is a fellow in the Geological Society of America and a member of the SEPM and American Geophysical Union. He was vice president of the West Texas Geological Society in 1935 and president in 1940.

SEPM Head. Dr. Harold N. Fisk, new SEPM president, is chief of the Geologic Research Section in Humble's Exploration department. He was born in Oregon, took an M.A. from the University of Oregon, did graduate work at the University of Cincinnati and Northwestern University, and was graduated from the University of Cincinnati in 1935 with a Ph.D. in geology. He joined Louisiana State University as an instructor and became a professor of geology in 1946. While on the university's faculty he served as research geologist in charge of field investigations for the Louisiana Geological Survey, consultant for the Mississippi River Commission, U. S. Army Engineers, and various law firms. Before joining Humble he did some contract geologic research work for the company. He began full-time employment for Humble in 1948 by helping to organize the work of the newly-formed Geologic Research Section in the Exploration department.

He is a member of Sigma Xi, Sigma Gamma Epsilon, and the Geological and Mining Society of American Universities, all honorary societies. He holds membership in several professional societies, the AAPG and the American Geophysical Union, and is a fellow of the Geological Society of America.

Roy L. Lay, SEG president, is manager of The Texas Company's Geophysical division. He received his B.S. degree in electrical engineering from Rice Institute in 1928 and joined Geophysical Research Corporation as an observer, later computer and party chief. He entered the employ of The Texas Company in 1932 as party chief, became field supervisor in 1937, assistant chief of the Geophysical division in 1943, and was promoted to his present position in 1945, with jurisdiction over The Texas Company's geophysical operations in the U. S. and Canada. He is a member

From left:

SAMUEL P. ELLISON, JR.
SEPM Secretary-Treasurer

BART W. SORGE
SEG Secretary-Treasurer

For outstanding achievement . . .

Honored for outstanding achievement were, left to right, FREDERIC H. LAHEE, winner of the AAPG Sidney Powers Memorial Award; ALEXANDER DEUSSEN, recipient of an AAPG honorary membership; DONALD F. TOWSE, winner of the AAPG President's Award; and HARRY R. JOHNSON, AAPG honorary membership. To THEODOR KREY went the SEG Best Paper Award.

of AAPG, Houston Geological Society, and has been affiliated with SEG since 1935. He was second vice president of the SEG Houston Section in 1947-48, president for the 1948-49 term, and served on the executive committee of the Houston Section from 1949 to 1951.

The Program. The general program had its beginning the night of March 23 with an illustrated lecture, "Under Tropic Seas," by Norman D. Newell, American Museum of Natural History and Columbia University, New York. Harold N. Fisk presided.

Honors were presented March 24 at the climax of a full day's program which included an address, "The Sinews of Industry," by Robert G. Dunlop, president of Sun Oil Company; and the president's addresses. Clifford C. Church, Tide Water Associated Oil Company, retiring president of SEPM, spoke on "Foraminifera, an Evaluation;" Curtis H. Johnson, General Petroleum Corporation, Los Angeles, retiring president of SEG, spoke on "Our Human Assets in Geophysics;" and Morgan J. Davis, Humble Oil & Refining Company, Houston, retiring president of AAPG, talked on "Contributions of the Petroleum Geologist."

The invocation was delivered by The Rt. Rev. Clinton S. Quin, Episcopal Bishop of Texas. Ray C. Lewis, president of the Houston Geological Society, gave an address of welcome.

Presiding were Carleton D. Speed, Jr., Houston consultant; Sigmund Hammer, Gulf Research & Development Company, Pittsburgh; and Henry V. Howe, Louisiana State University, Baton Rouge.

The afternoon session was devoted to topics of broad scope, including "Oil Discovery Trends," by Paul R. Schultz, Stanolind Oil & Gas Company, Tulsa; "Geology, Geologists, and Man," Carey Croneis, Beloit College, Beloit, Wis.; "The Occurrence of Hydrocarbons in Recent Marine Sediments," P. V. Smith, Jr., Standard Oil Development Company, Linden, N. J.; "The Salt Volumes of Gulf Coast Salt Domes," Sigmund Hammer; "Politics Threaten World Oil Adequacy," Warren L. Baker and Donald E. Kliewer, WORLD OIL, Houston; and "Radioactive Mineral Exploration," by F. H. Lahee.

Read by title was a paper, "Exploratory Drilling in 1952," by Lahee. Ray C. Lewis, Houston Oil Company, Houston, and John M. Vetter, Pan American Production Company, Houston, presided.

New developments in exploration occupied the delegates at a joint session on the morning of March 25. Papers given were "Application of New Techniques to Basic Objectives in Paleontology," by Heinz A. Lohenstam, California Institute of Technology, Pasadena; "Some Recent Developments in Well Logging," Loy M. Charter, Shell Oil Company, Los Angeles; "Environmental Interpretation of Facies Maps," W. C. Krumbein and L. L. Sloss, Northwestern University, Evanston, Ill.; "Geophysical Progress," Henry Cortes, Magnolia Petroleum Company, Dallas; "Aeromagnetic Anomalies over Known Structures and Oil Fields," N. C. Steenland, Gravity Meter Exploration Company, Houston; and "Seismograms as an Aid to Geological Interpretation in the Poza Rica Area," D. W. Rockwell, Geophysical Service, Inc., and Ing. Antonio Garcia Rojas, Petroleos Mexicanos, Mexico.

Presiding at this session were Ralph B. Cantrell, Houston consultant, P. L. Lay, and Clifford C. Church.

The afternoon of March 25 was devoted to a symposium on the sedimentary history of the Gulf Coast geosyncline. Papers included: "Setting of the Gulf Coast Geosyncline," by Harold N. Fisk; "Recent Geology of the Northern Gulf of Mexico Region," by Rufus J. LeBlanc and Norman N. Greenman, Shell Oil Company, Houston; "Stratigraphy of the Coastal Plain in Southeastern Alabama, Florida and Georgia," by Lyman D. Toulmin and Louise Jordan, University of Florida, Tallahassee; "Geology of the Central Gulf Coastal Plain," Tom H. Philpott, The Carter Oil Company, Shreveport; "Post-Eocene Sediments of Louisiana, Mississippi and Western Alabama," Leslie Bowling and L. C. Aycock, Bowling and Claudet, New Orleans; "Sedimentary Environments of the Gulf Tertiary of Texas," H. B. Stenzel, Bureau of Economic Geology,

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Austin; and "Evidence of the General Structure of the Gulf Coast from Geophysical Data," by Paul Weaver, Gulf Oil Corporation, Houston.

Presiding were Marcus A. Hanna, Gulf Oil Corporation, Houston and H. V. Howe, Louisiana State University, Baton Rouge.

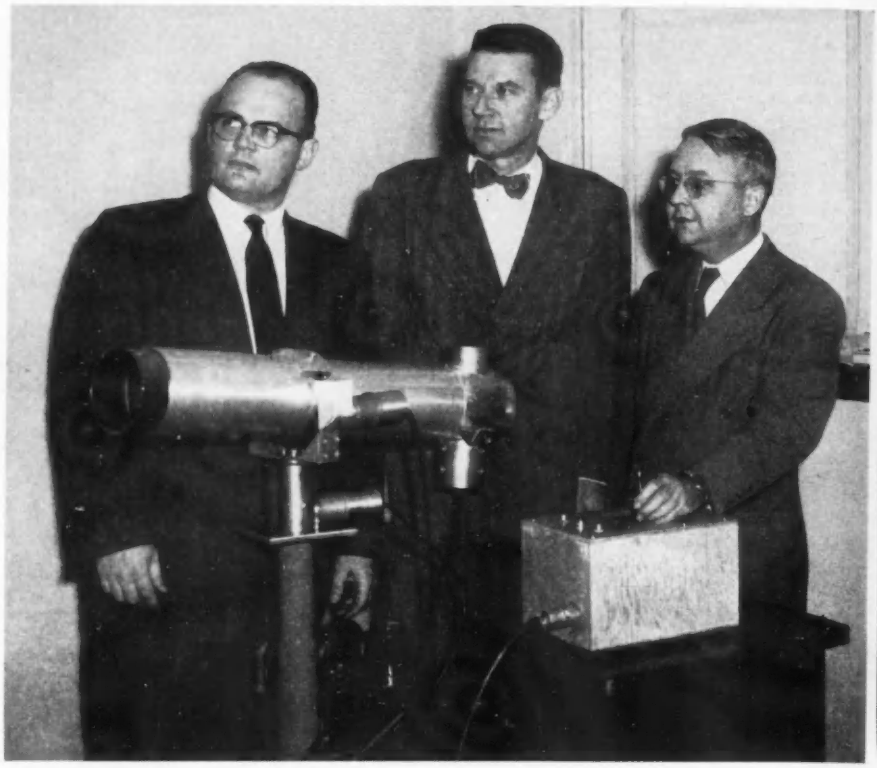
Still another session on March 25 was a panel discussion of the Gulf Coast geosyncline, with George A. Buchanan of Sohio Petroleum Company, Houston and Hanna presiding. Members of the panel were Leslie Bowling, Louise Jordan, H. B. Stenzel, H. N. Fisk, Rufus J. LeBlanc, Lyman Toulmin, Norman Greenman, T. H. Philpott and Paul Weaver. Hanna gave a summary of the afternoon papers.

Some of North America's most interesting basin areas were discussed March 26. The talks included: "Geology and Oil and Gas Possibilities of Western Washington," by W. L. Stanton, The Union Oil Company of California, Sacramento; "Oil and Gas Prospects of the Delaware Basin, Texas and New Mexico," by T. F. Harriss, Midland consultant; "Tectonics and Its Relation to Oil and Gas Production in the Four Corners Area of New Mexico, Colorado, Arizona, and Utah," by Paul H. Umbach, consultant of Albuquerque, N. M.; "Geology and Petroleum Possibilities of the Gulf of Alaska Tertiary Province," by Don J. Miller, U. S. Geological Survey, San Francisco; and "Results of Petroleum Exploration in Naval Reserve No. 4 and Adjacent Areas, Alaska," by George Gryc, U. S. Geological Survey, Washington, and Comdr. R. C. Jensen, U. S. Navy, Washington.

Presiding were Wallace Thompson, General Crude Oil Company, Houston; and John G. Bartram, Stanolind Oil & Gas Company, Tulsa.

Foreign oil developments were reviewed in a session presided over by Perry Olcott and Cecil V. Hagen, consultants, Houston. Talks were "The La Brea-Parinas Oil Field, Northwestern Peru, S. A.," by Russell B. Travis, International Petroleum Company, Limited, Talara, Peru; "Oil Fields of the Mercedes Region, Venezuela," by J. M. Patterson and J. G. Wilson, Texas Petroleum Company, Caracas, Venezuela; "Petroleum Prospects of Denmark," Charles W. Flagler, Gulf Oil Corporation, New York; and "Oil in Algeria and Morocco," J. Brian Eby, Houston consultant.

Committee Heads. Committees responsible for the success of the convention were under the general chairmanship of Carleton D. Speed, Jr., Houston consultant. Vice chairmen were Ralph Cantrell, consultant, AAPG; M. B. Stephenson, Stanolind Oil & Gas Company, SEPM; and Roy L. Lay, The Texas Company, SEG.



Technical equipment committeemen try out the new optical pointer designed by The Texas Company's geophysical research laboratory for the joint meet. From left is Frank V. Stevenson, chairman of the committee, Eugene Frowe, and B. D. Lee, developer of the optical pointer.

Audience Got the Point!

A REMOTE CONTROLLED optical pointer aided the presentation of the more than 75 technical papers at the convention of three exploration societies.

B. D. Lee, research geophysicist in The Texas Company's geophysical laboratory in Houston, developed the basic ideas of the optical pointer. B. H. Towell, chief designer at the laboratory, was the mechanical designer, and L. M. Evans, mechanical engineer, was the optical designer. The two designs were coordinated by Towell.

Like most inventions, the new optical pointer was born through necessity.

Frank V. Stevenson, Alcoa Mining Company geologist and chairman of the convention's technical equipment committee, had arranged for an 18 by 20-foot screen to be used in illustrating the papers. The screen was too large for manual pointers.

Standing about 100 feet away from the large screen, the speaker can control the optical pointer through the use of a joystick, just as early airplanes were controlled.

A special type of light bulb, unique in that it does not require the use of glass condensors for a small, high intensity light-spot, was needed in the development of the invention and had to be imported from England.

Two of the optical pointers were ready for use during the convention.

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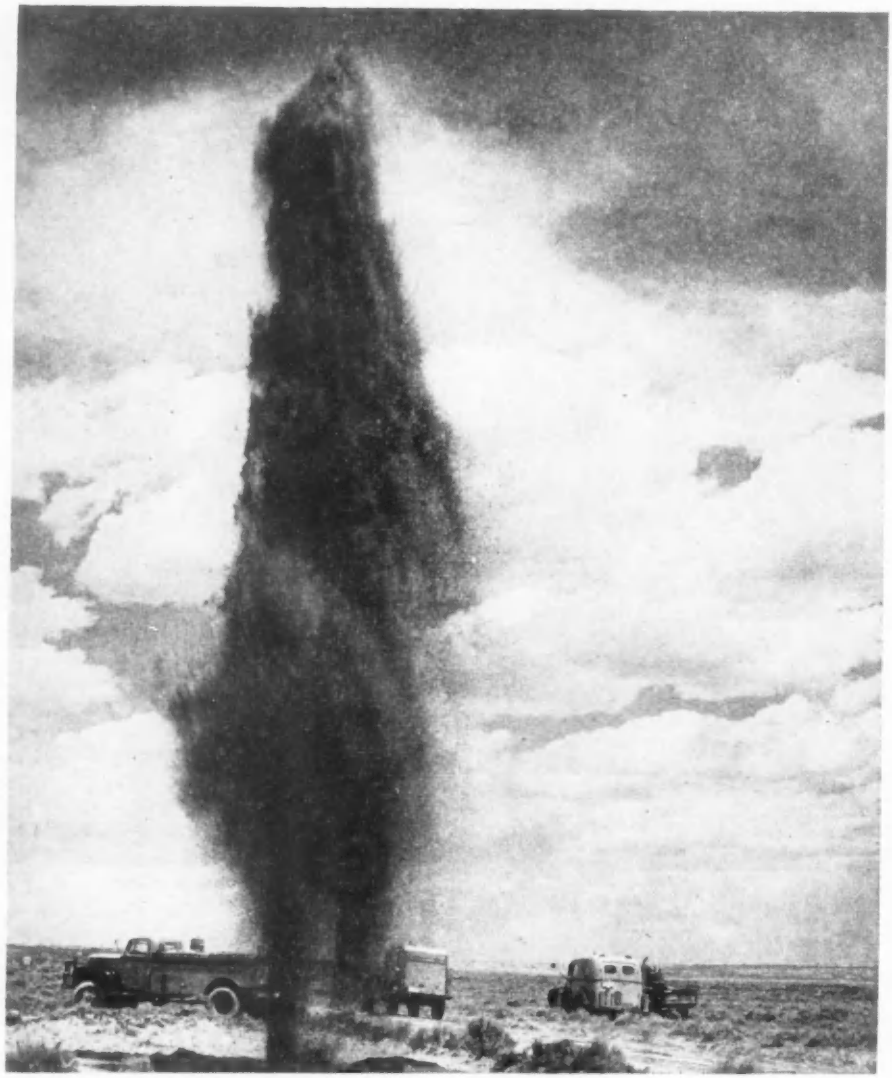

Geophysics leads the way to oil fields of the future—on arid plains, in infested swamps on open waters.

Geophysical Activity Reaches All-Time High in 1952

The SEG committee reports—905 crews saw full-time service last year.

By DR. E. A. ECKHARDT
Gulf Research & Development Company, Pittsburgh, Penn.

GEOPHYSICAL ACTIVITY during 1952 reached a new all-time high. On the basis of incomplete reports, the full-time services of 905 crews were utilized the world over last year, an increase of 114 crews over 1951. The 9801 crew-months of seismograph work in the U. S. and Canada alone exceeded the 9549 crew-month world total of such work in 1951.

The figures at hand indicate a slight decrease in gravity operations, but it is believed that when data now missing are received a slight increase will be shown. The reports received on magnetometer activity seem to be neither complete nor reliable, and no attempt seems justified to estimate a trend.

Exploration results appear to have fallen well below the preliminary estimates. Total liquid hydrocarbon reserves proved during 1952 were estimated by API to be about 3.30 billion barrels. Deducting the 1952 production of 2.55 billion barrels, the net addition to reserves was only 750,000 million barrels, which was lower than it was for any year since 1947.

Although U. S. reserves at the beginning of this year stood at an all-time high of 32.96 billions of barrels of liquid hydrocarbons, it is to be noted that this represents only 12.9 years of supply at last year's rate of production. In 1929, U. S. production first exceeded one billion barrels, and in 1952 it was, for the first time, greater than 2.5 billion barrels.

In this interval reserves fluctuated between a minimum of 11.9 years of supply at current annual rates of production to a maximum of 15.7 years. The average over this period was 13.4 years. The magnitude of our present reserves, though of record proportions, is not so when expressed in terms of years of supply at current production rates, being below the average for the last 23 years.

In fact, the ratio of total reserves to annual production seems to be less for the U. S. than for any country or area which produces as much as 1 percent of the world's oil. The supply-demand relationship appears to be currently causing the industry some concern, but in this connection it may be well to remember that in terms of years of supply present reserves are low rather than high.

Seismograph Adjustment. The month-by-month fluctuation of both seismograph and gravity operations in the U. S. is shown for the 1942-1952 period in Figure 1. The most striking feature of this picture is the rapid rise of seismograph activity which began very early in 1950 and culminated in October of last year. This rise carried from a low of 417 crews in 1950 to a high of 710 crews in 1952, representing an increase of about 70 percent over a period of less than

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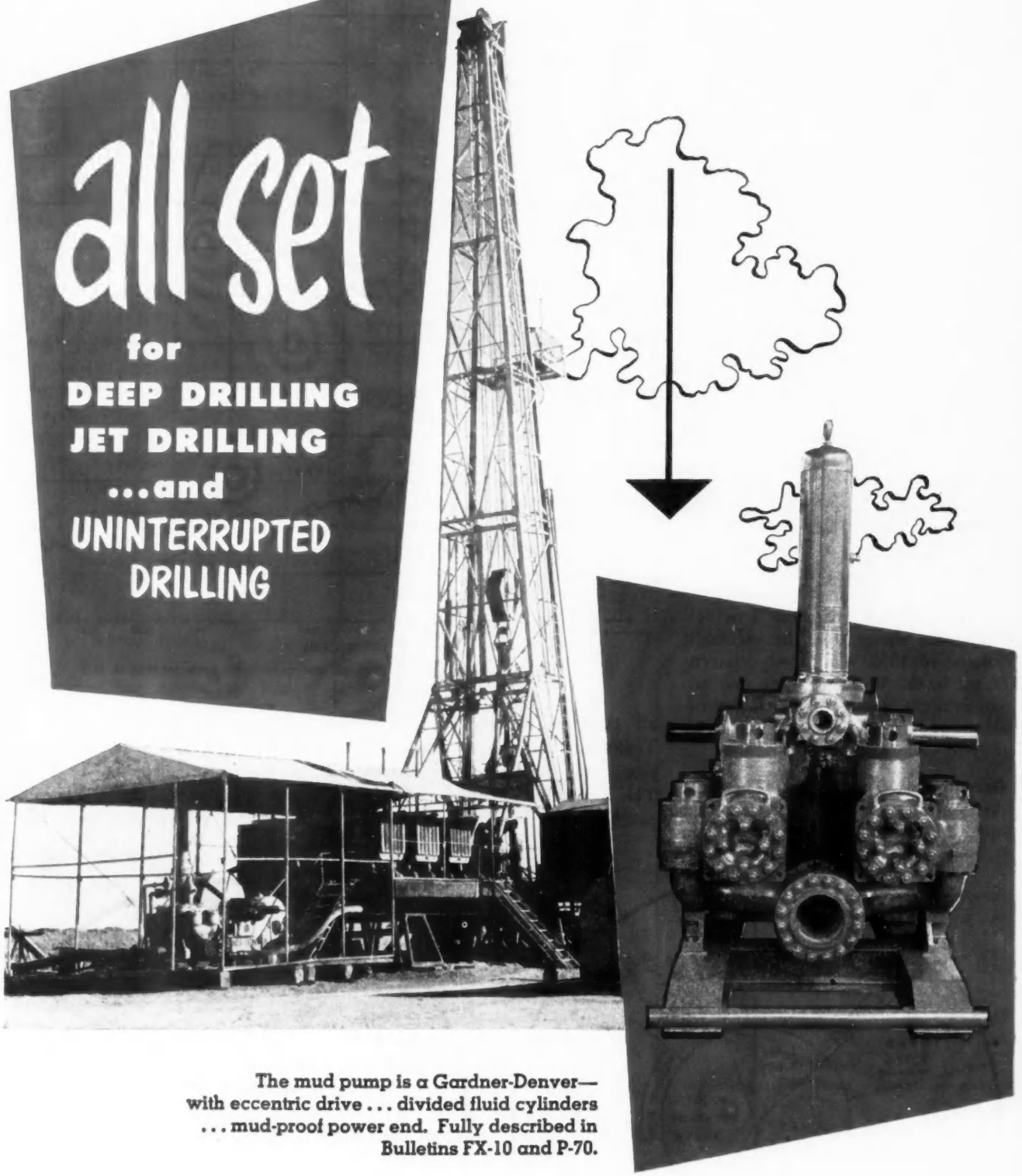

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three years. By January 1953 the number of crews had dropped to 641, a drop of less than 10 percent, possibly indicating that we are currently experiencing the kind of adjustment which was encountered in 1949. Related factors are hardly such, at this time, to justify the more pessimistic view that the history of 1937-1941 may be repeated.

The gravity graph in Figure 1 shows that these operations of last year in the U. S. fluctuated about the highest level reached the preceding one. The 1952 activity came to a total of 965 crew months against 802 for 1951, an increase of 20 percent.

The geographic distribution of the 1952 U. S. seismograph operations is shown in Figure 2. For the first time since these reports were initiated six years ago, Texas and Louisiana together account for less than one-half of the total activity. The concentration of work in the Rocky Mountain states, and more particularly in the Williston Basin, is evident in the chart. Table 1 is presented to give additional information concerning the growth and shifts of these activities. The table shows that the increased volume of 1952 was largely concentrated in the Williston Basin and adjacent areas, and that this concentration resulted in decreased activity only in Colorado.

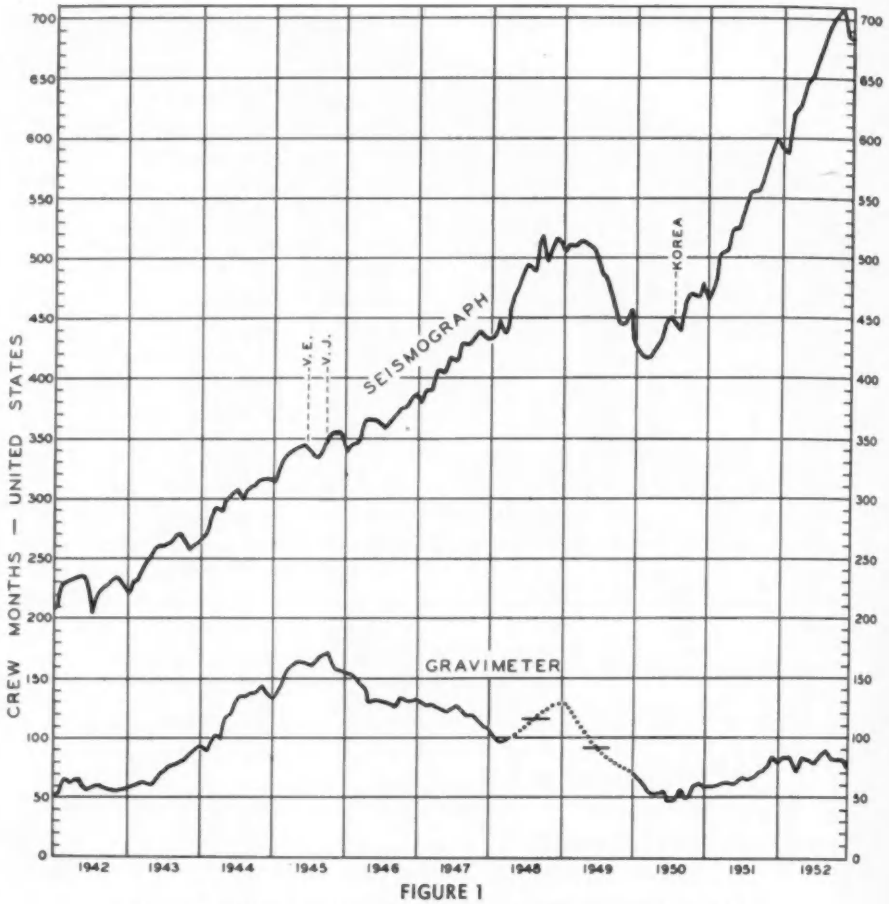


FIGURE 1
Monthly variation in seismograph and gravimeter crew months in U.S.

Gravimeter Operations. The areal distribution of 1952 U. S. gravimeter operations is shown by Figure 3. As in all previous reports of this series, Texas and Louisiana accounted for more than half of the year's work. The distributional changes from the preceding year were pronounced and are indicated in Table 2. There were increases in six and decreases in four of the states listed. The increases were greatest percentagewise in Montana and Mississippi, and the de-

FIGURE 2
Distribution of 1952 seismograph operations in U.S.

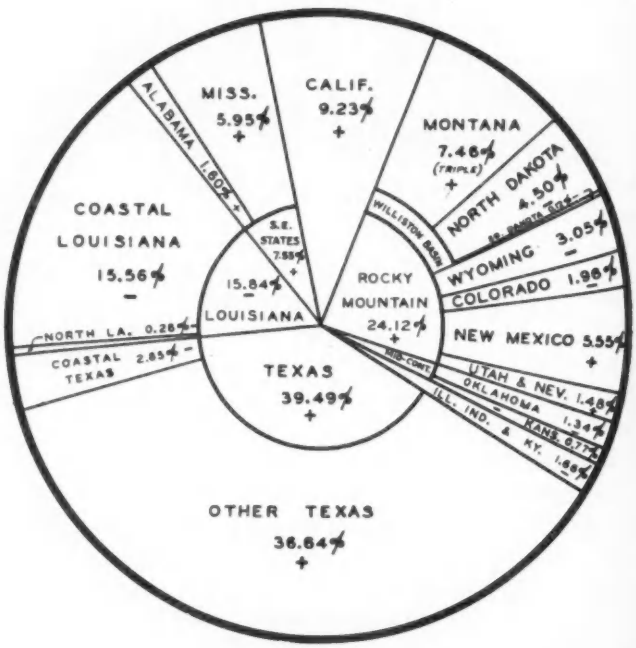


FIGURE 3
Distribution of 1952 gravimeter operations in U.S.

creases largest in Oklahoma and Colorado. There was an over-all increase of approximately 20 percent.

Next to the U. S., geophysical activity was greatest in Canada. Seismograph operations increased by 24.6 percent from 1479 crew-months in 1951 to 1843 crew-months in 1952. Gravity operations showed a reverse trend, declining from 147 crew-months to 114, a decline of 22.4 percent. Enough data are now available to present the course of geophysical activity in Canada over a period of seven years, and this is done in Figure 4.

For all of North America, 10,049 crew-months of seismograph work and 1127 crew-months of gravity work were reported for 1952. The corresponding figures for 1951 were 8248 and 1493, respectively. Next to the U. S. and Canada, Mexico was the principal contributor to these totals. There was, however, little change in the level of operations in Mexico from 1951 to 1952.

In South America seismograph operations increased from 349 crew-months to 459, the increases occurring principally in the Argentine, Venezuela and Colombia. Gravity operations increased from 114 to 158 crew-months, and the increases were accounted for largely by Peru and Venezuela.

Data Incomplete. Up to the closing time of this report, the data received for the Eastern Hemisphere were not sufficiently complete to justify the presentation of charts or tables. In 1951 Germany and Italy accounted for nearly half the geophysical work done in the Eastern Hemisphere. Though no precise data are available, reliable estimates indicate that the 1952 volume of work in these two countries was greater than the year before. It is impossible to say by how much. The total for the Eastern Hemisphere was also probably as great as or greater than last year.

For the geophysical work done in 1952 for its account, the oil industry probably spent between $350 million and $400 million. The increase over 1951 was largely due to increased volume, but partly also to increased unit costs.

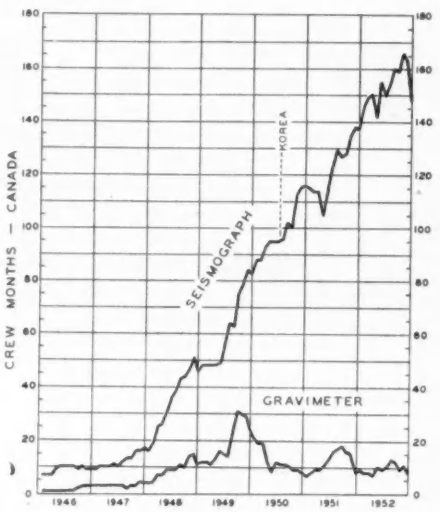


FIGURE 4
Monthly variation in seismograph and gravimeter crew months in U.S.

It is clear that whatever the economic climate may be in the next year or two, increased exploration will be necessary because of the inevitably increasing demand for petroleum products. Over the years geophysical activity is bound to rise. The big problem faced by the operators is manpower. For the most part, geophysical organizations are concentrating on getting a larger portion of college graduating classes. There is a growing realization that more than this will be required.

Dr. E. A. Eckhardt

an annual report

This authoritative report on the past year's geophysical activity is made annually by the Committee on Geophysical Activity, headed by Dr. E. A. Eckhardt of Gulf Research and Development Company.

Training Vital. The development of our natural resources is basic to the well being of our economy. Yet the percentage of high school students who receive any kind of training in the earth sciences has been decreasing continuously and markedly in the last 50 years. It was nearly 30 percent in 1900. It is a fraction of 1 percent today. Since the interests of young men are directed to a considerable extent before they arrive at college, this tends to minimize the college enrollment in earth science subjects.

Dr. H. Cloos has dealt with this subject in a recent issue of the *News Letter* of the American Geological Institute. High school students must be made familiar with the earth sciences, job opportunities they offer, and their importance. This is a natural function for the AGI, and the manpower problems of geophysical operators are likely to receive most effective attention through their support of the Institute.

It is appropriate to pay tribute to the technical press which serves the oil industry and which has afforded much valuable information which has provided background for this report. Probably no industry is better served by its technical press than is the oil industry.

ACKNOWLEDGMENT

Report of the Committee on Geophysical Activity of the Society of Exploration Geophysicists. The members of this committee are A. A. Brant, Herbert Hoover, Jr., R. Vajk and E. A. Eckhardt, Chairman. Report presented at the Houston meeting of the society, March 23, 1953.

TABLE 1

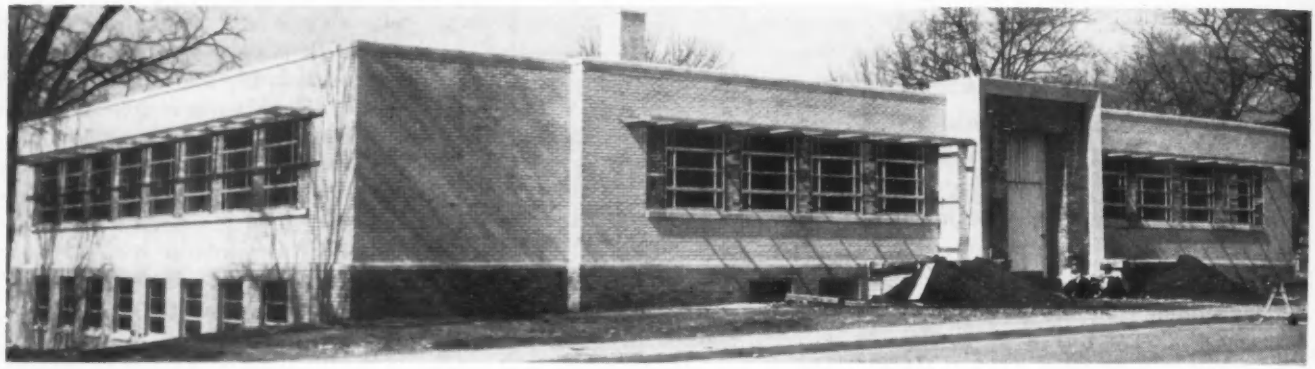
Seismograph Crew Months in the U. S.

STATE	1951	1952	Percent Change
Texas	2574	2670	+ 3.7
Louisiana	1041	1083	+ 4.0
Mississippi	148	203	+ 37.2
Oklahoma	371	411	+ 10.8
New Mexico	496	657	+ 32.5
Colorado	297	252	— 15.1
Wyoming	317	519	+ 63.7
Montana	255	574	+125.1
North Dakota	122	436	+257.4
California	208	283	+ 36.1
Other	708	870	+ 21.5
Total	6537	7958	+ 21.7

TABLE 2

Gravity Crew Months in the U. S.

STATE	1951	1952	Percent Change
Texas	294	381	+ 30
Louisiana	192	153	— 20
Mississippi	15	57	+280
Oklahoma	28	13	— 54
New Mexico	36	54	+ 50
Colorado	35	19	— 46
Wyoming	43	30	— 30
Montana	17	72	+320
North Dakota	39	43	+ 10
California	43	89	+107
Other	60	54	— 10
Total	802	965	+ 20



New headquarters building of the AAPG in Tulsa, Okla.

AAPG Moves Into New Headquarters in Tulsa

THE NEW HEADQUARTERS building of the American Association of Petroleum Geologists, in Tulsa, Okla., was dedicated March 20, just prior to the annual convention in Houston. The building is located ten blocks south of the heart of Tulsa's business district in a neighborhood that is rapidly developing as an oil-headquarters center.

The property is directly across the street from the present national headquarters of the Independent Petroleum Association of America. Skelly Oil Company plans to construct a large office building in the next few years on the IPAA location. The IPAA has purchased the site immediately north of the AAPG building, and will start construction in the near future. At the north end of the block containing the Skelly property, Kewanee Oil Company recently purchased a site for a three-story building. The building is now in the late stages of planning.

The AAPG headquarters is L-shape, with 100-foot frontage on Boulder Avenue, and extends 70 feet along the Fifteenth Street side. It is light buff brick with cut limestone trim. Construction is of structural steel, concrete and masonry, and the building consists of one floor and a basement, with provisions for the addition of a second floor. The building is so placed on the lot that another wing can be added if needed. There is ample space for on-the-lot parking.

The building contains a gross floor space of 10,600 square feet, and a possible total net office and storage space of 6900 square feet, if the south wing of the basement is finished off into offices. At present, the association business offices are located on the main floor and are entirely air-conditioned.

The AAPG was founded in Tulsa in February, 1917, and grew out of a series of informal meetings held during 1915, and a called meeting of the geologists working in the Southwest, held at Norman, Okla., in January, 1916. At the Norman meeting it was decided that an organization was desirable, but that the necessary steps should not be taken until the next meeting, to be held in Tulsa. At the Tulsa meeting, the organization was named the Southwestern Association of Petroleum Geologists. At the following meeting, in Oklahoma City, Feb. 15 and 16, 1918, the constitution was adopted, with an amendment changing the name to American Association of Petroleum Geologists.

The new headquarters building is dedicated to the founders, and the executive committee of the association decided that those who had attended any of the preliminary meetings, and/or the organization meeting in Tulsa should be considered founders. Extensive research by association officers and staff resulted in the compilation of a list of 120 founders. A bronze plaque, designed by Lawrence Tenney Stevens, Tulsa sculptor, dedicating the building to these 120 men, is to be placed in the entrance corridor, opposite the reception desk.

The Petroleum Geologist

■ CONTINUED FROM PAGE 74

petroleum geologist has often been able to aid in promoting good public relations by fostering a spirit of fair dealing and by recognition of the rights of all concerned. Through his activities he has helped to stimulate an interest in geology and related sciences among the petroleum consuming public. In time of war he has helped in various ways, including the planning of attacks by interpretation of conditions of terrain from air photos and by marshaling his training in observation and coordination for the assistance of intelligence and other branches of the services.

The geologist may well take pride in his contributions to the petroleum industry. He has actively participated in most phases of the oil-finding effort for the past forty years. It has been his function to lead the way in exploration since it first seemed worthwhile to theorize on the nature of oil occurrence, since he was first called upon to identify suitable areas in which to search for petroleum, and since he first attempted to predict the nature, attitude, and extent of potentially productive beds. The need in the industry for geological thinking and sound interpretations of geologic data has increased as the exploration effort has become more complex. For this reason the future of the geologist in the petroleum industry continues to be bright and to grow more secure.

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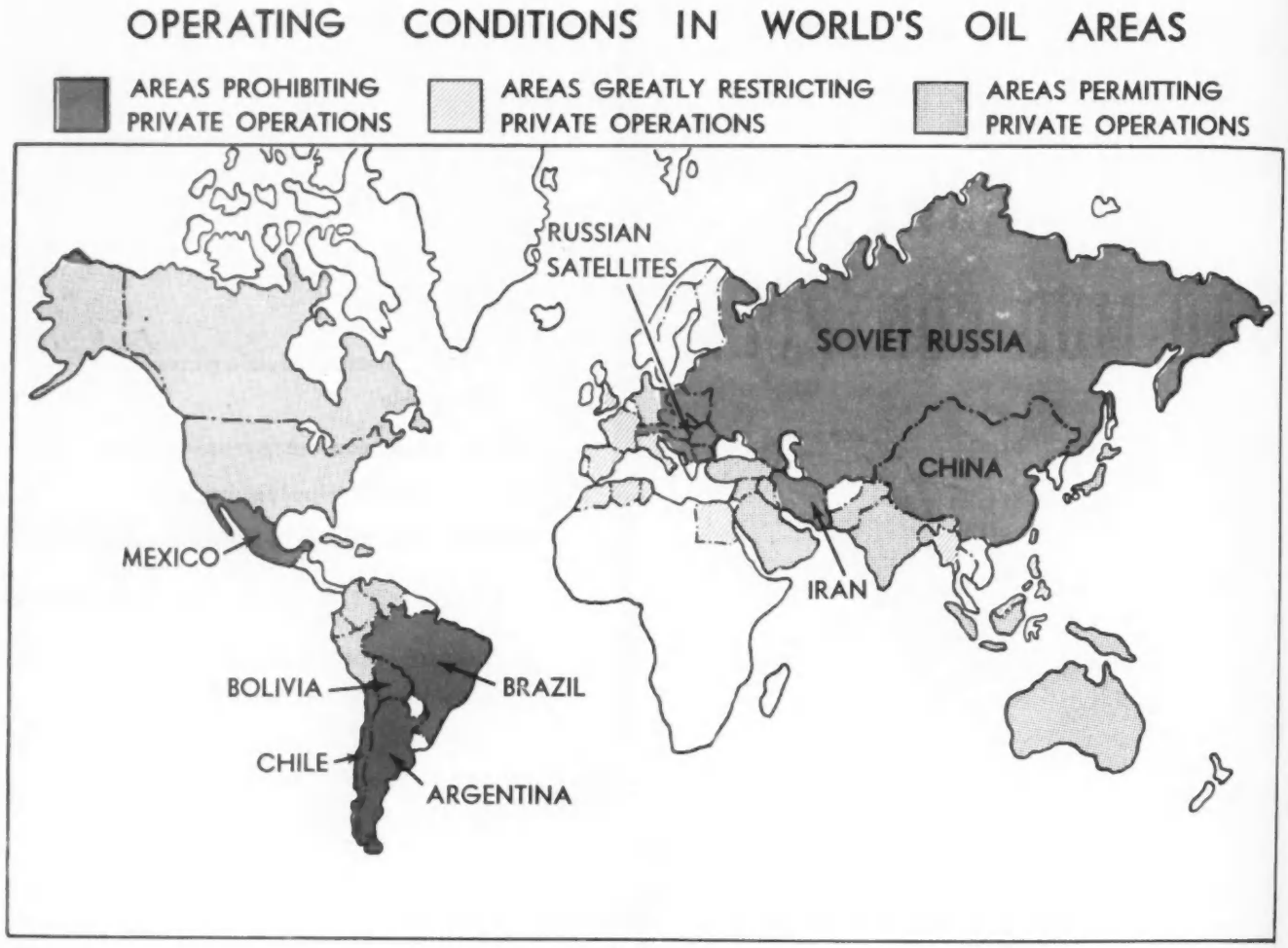


FIGURE 1

Politics Threaten World Oil Adequacy

There's plenty of petroleum for the future. There's adequate technical ability to develop fields. But there's a catch.

By WARREN L. BAKER, Editor
and **DON KLIEWER,** WORLD OIL Staff

WORLD CONSUMPTION of petroleum has risen at an astounding pace in recent years. Consuming rates in 1952 were a third greater than in 1949, twice as much as in 1940, and three times more than in 1935.

Yet, thanks to tremendous expansion by privately owned business enterprises, supply has kept pace with demand.

A need for further vigorous growth at record-smashing rates lies immediately ahead. Mechanization and industrialization are growing at a faster pace today than ever before in many parts of the world. This indicates additional sharp gains in consumption of petroleum.

Therefore, the supply task ahead is greater than ever before. Substantially larger discovery and producing rates than recent peak volumes must be achieved and maintained to keep supply abreast of demand.

Geologically, there exists an apparent sufficient supply of oil for many years. Vast regions of the world with favorable oil possibilities and potentialities await intensive exploration and development.

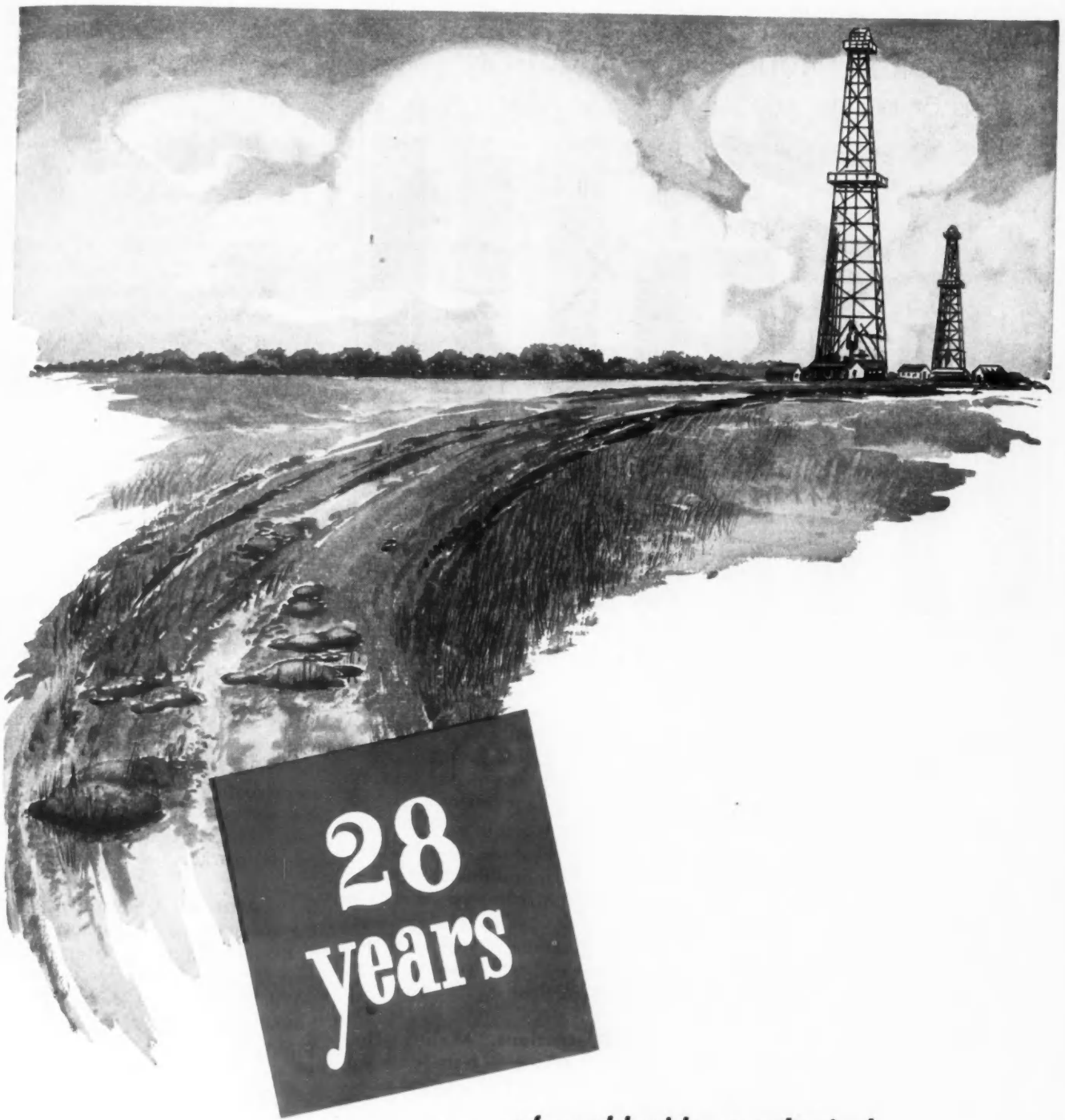
Technically, there is an abundance of ability with which oil supplies can be found and developed. Additional technological progress promises to continue increasing future petroleum supplies.

What's the Catch? Provided it is given proper incentives and working conditions, there is every reason to believe the oil industry can make available sufficient supplies of oil to meet future expanded consuming rates.

But there's a "catch," unfortunately.

Development of petroleum supplies to meet increased future world needs is coming to depend more and more on political conditions and less and less on geologic possibilities and technical ability. This trend is creating grave doubts as to how long the free world's spiraling requirements for oil can be fully satisfied.

Restrictive laws and insecure politi-



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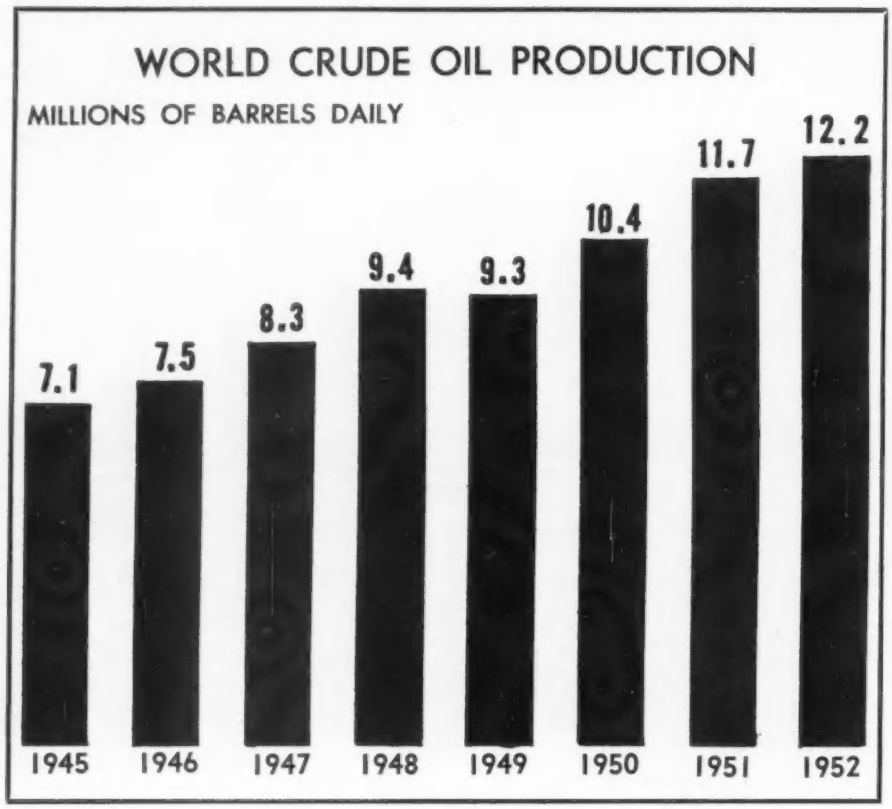

FIGURE 2

cal atmosphere are stumbling blocks now discouraging the search for oil by private companies in a growing number of countries. These twin barriers threaten to stifle the development of adequate future supplies by closing the doors to private business. And private business enterprise is the only group with the know-how and financial resources required to discover and develop oil in tremendous volumes.

In addition to the growth of outright Communism until it smothers a vast portion of the world, the threat of nationalization, confiscation and expropriation is more prevalent today than ever before. In one country after another, oil resources have been nationalized.

Figure 1 shows how extensive an area of the world has been closed to private oil operations. Most of Asia, much of Europe and South America, and a small portion of North America have nationalized oil operations today.

Russia, Brazil, Mexico and Bolivia —to mention a few—took the road to nationalism long ago. Recent nationalization of Iran's oil industry through outright abrogation of a contract shook the already uneasy confidence of private business in foreign exploration.

In addition to those countries which have enacted outright nationalization, others have enacted stringent legislation operating against the best interest of private operations.

Legislation passed in various countries limits operations to their own nationals or requires that the government have controlling or substantial interest in any oil exploration companies. Limitations of this nature are common over a goodly part of Europe and North Africa.

Other Restrictions. Many other trends are serving to restrict the opportunity of private oil capital to engage in foreign operations in entirely too large a portion of the world. In too large a portion for the good of the nations in particular and the world in general.

These factors include excessive taxation and other monetary payments. These conditions exist in many nations still open to private business operations, but either economic or political alterations could easily and quickly reverse the trend.

For example, Venezuela is often described as an example of how private business can be permitted to function in foreign lands. This reputation was built up with liberal treatment by the nation during the days when its oil industry was a fledgling. As a result, Venezuela now is the second largest oil producing country.

But even in Venezuela, exactions have lately burdened oil industry operations.

Increased royalties, compulsory home refining, special taxation, artificial pricing of royalty oil, adverse currency restrictions, and underallowance for transportation have been imposed. In Venezuela, too, originated the spreading 50-50 formula by which governments enjoy production profits on an equal basis with producers. And no new concessions have been granted in Venezuela since 1946.

Even here at home in the U. S., which long has been recognized as the world's outstanding example of democratic free enterprise, conditions are not as encouraging as they once were.

The industry cannot plow huge sums from earnings back into a business which operates under an appalling tax structure. Venture capital, the source of new money, shrivels under high taxes. And if such high tax rates are long maintained, they will impair the very foundation so necessary to an expanding industry which, in turn, is so necessary in the effort to develop more oil for expanding and newly-created markets.

U. S. Attitude. Unfortunate, too, is the attitude of the U. S. government. It has actually encouraged other nations in their tendencies to prohibit oil development by foreign private business. Excessive taxation at home promotes excessive taxation in countries where oil is produced by American private business.

When the U. S. government through a series of attacks implies that American oil companies are guilty of cartels or other malpractices, it is not difficult to imagine how citizens and officials of other nations will react toward these same concerns. Communists use these attacks to generate disquiet and to destroy confidence in American oil companies.

What is at stake is bigger than the interest of any oil company, bigger than the ambition of anyone in or out of government who may wish to redesign the pattern of the oil industry. What is at stake is the same thing that is hanging in the balance wherever

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East meets West: free enterprise versus the state ownership advocated by Soviet Russia.

The increasing world dependency upon foreign oil sources for adequate supplies to satisfy pyramiding consumption places great significance on these trends. Foreign production has become more and more important to the world oil picture in recent years (Figure 2).

In response to skyrocketing demand, world crude production has risen sharply in recent years, reaching 12¼ million barrels a day in 1952. This was a fourth more than the less than 10½ million barrels produced daily in 1950; two-thirds greater than the 1945 production of 7 million barrels a day.

A major share of the increase in world production during recent years has come from outside the U. S. (Figure 3). Despite the sharp gain in U. S. production from 4⅔ million barrels in 1945 to more than 6 million barrels in 1952, output outside the U. S. has risen much more rapidly. Whereas two-thirds of the world's production came from the U. S. in 1945, this country accounted for only half of the 1952 yield. In 1945 the U. S. was producing almost twice as much oil as the remainder of the world. However, the gain in foreign production has been so rapid, output is expected to equal that of the U. S. in 1953. Production from outside the U. S. has risen from less than 2½ million barrels daily in 1945 to 6 million barrels a day in 1952.

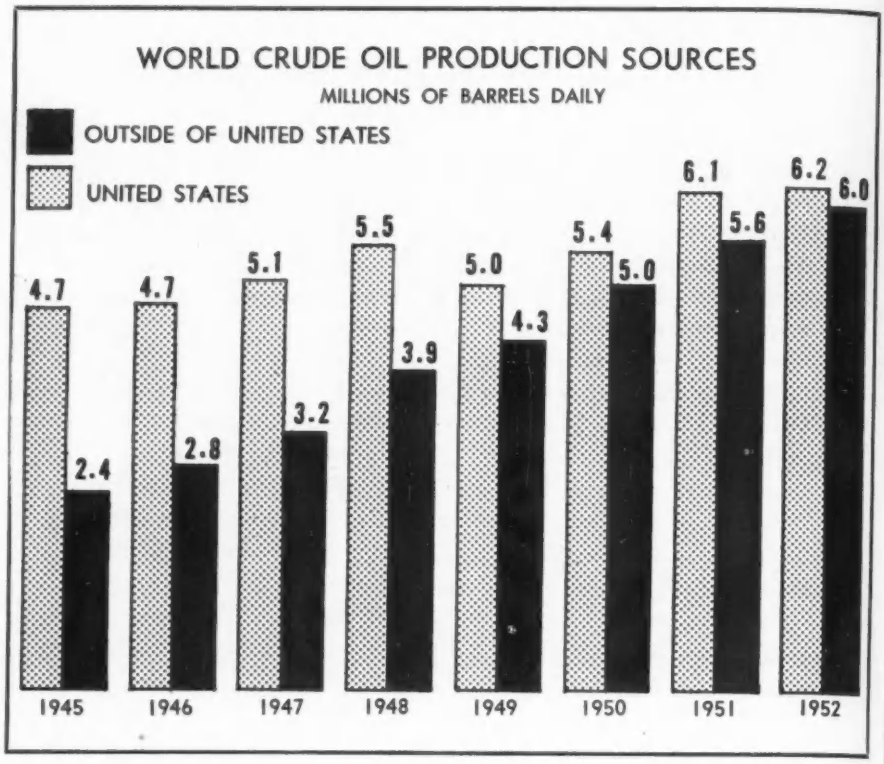

FIGURE 3

What's the Reason? Large gains in Middle East and Venezuela have been responsible for the increase in production outside the U. S. Middle East production in 1952 exceeded 2 million barrels daily, compared with half a million barrels a day in 1945. Middle East production has continued to rise despite shutdown of Iran's 700,000 barrels a day in 1951.

Venezuela's production of 1¾ million barrels per day in 1952 compared with less than a million barrels in 1945.

Practically all the growth in world production rates in recent years has resulted from private companies' endeavors. And many of those companies are American organizations (Figure 4).

Private company operations accounted for almost 7 million barrels of the 7½ million-barrel-a-day gain in world crude output between 1935 and 1952.

Production by governments increased only half a million barrels daily between 1935 and 1952, despite a great growth in the number of countries with nationalized oil industries.

Between 1945 and 1952 production of private oil companies increased almost 4½ million barrels daily, while government operations were advancing only ¾ of a million barrels daily.

Despite the extensive area of the globe now prohibiting private company operations, only 1⅓ million barrels of the world's 12¼ million-

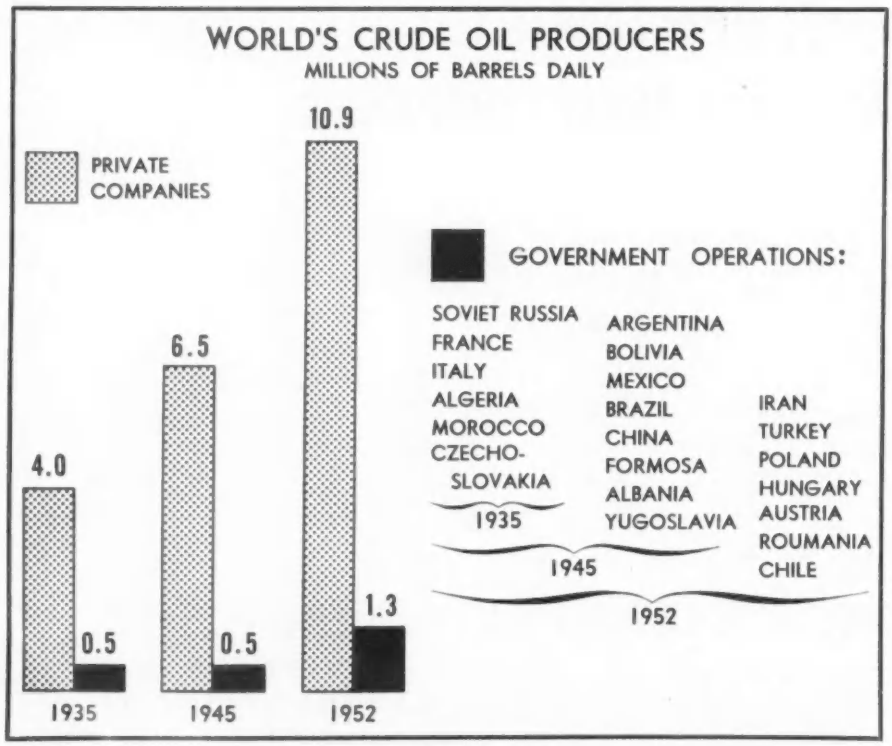

FIGURE 4

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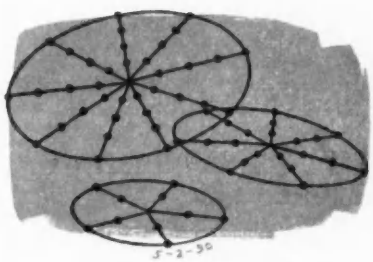

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barrel-a-day production in 1952 was produced by countries whose oil industries operated under government monopolies. Private oil companies in 1952 provided the world with nearly 11 of its 12¼ million barrels of daily production.

There is not a single example of a government monopoly making an outstanding success in the oil business.

Few areas have been blessed with as much excellent oil prospecting territory as Soviet Russia. Under private business, it was the world's leading oil-producing area before the turn of the century. Yet, this giant nation today produces only 850,000 barrels daily, about an eighth as much as the U. S.

While this is five times greater than Russia's 1918 output, it is only 675,000 barrels a day more although it has been operating under a state-owned monopoly during all of these 35 years.

Crude Oil Production History of Government Owned Companies or Agencies

	GOVERNMENT OWNED PRODUCTION—Barrels per Day			FUTURE DISCOVERY POSSIBILITIES	REMARKS
	1935	1945	1952		
U.S.S.R. (Including Sakhalin)	506,660	391,275	850,820	Excellent Vast Area	Nationalized 1918. Private companies produced 172,800 barrels daily in 1917. Prior to 1900, Russia was world's leading producer. Low 1945 yield due to war.
ARGENTINA	Privately Owned	42,400	51,195*	Good Over Vast Area	Nationalized 1935. Private companies produced 38,422 barrels daily in 1934, and from retained properties produced 20,349 barrels daily in 1945 and estimated 15,300 in 1952.
BOLIVIA	Privately Owned	1,115	1,500	Good Sizable Area	Nationalized 1937. Private companies produced 288 barrels daily in 1936. Practically all current production from fields discovered by private companies.
MEXICO	Privately Owned	119,305	215,285	Excellent Big Area	Nationalized 1938. Private companies produced 128,512 barrels daily in 1937. Current production mostly from fields discovered by private companies, principally prolific Poza Rica field found in 1934.
BRAZIL	No Production	215	2,024	Good Over Big Area	Nationalized 1938. First production 1939. Present fields restricted to small area near coast.
CHINA	No Production	1,370	2,000	Fair	Nationalized. First production 1939.
FORMOSA	No Production	40	40	Poor	Nationalized 1945. First production 1941. Operated by Japanese Government 1941 to 1945.
ALBANIA	Privately Owned	730	2,760	Poor	Nationalized following war. First production 1933. Italian government company conducted operations from some years prior to 1945.
CHILE	No Production	No Production	2,245	Fair	Nationaljzed 1943. First production found 1945.
ROUMANIA	Privately Owned	Privately Owned	81,200	Good	Russian Satellite Nationalized 1948. Private companies produced 168,000 barrels daily in 1935, and despite war 94,526 barrels in 1945. Practically all current production from former private properties.
AUSTRIA	Privately Owned	Privately Owned	47,500	Poor	Oil fields in Russian sector. Nationalized 1948. Private companies produced 120 barrels daily in 1935 and despite war 8,408 barrels daily in 1945. Current production mostly from former private properties.
HUNGARY	No Production	Privately Owned	9,200	Poor	Russian Satellite. Russian-Hungarian government company has operated fields since 1946. First production in 1936. Private companies produced 13,756 barrels daily in 1945.
CZECHOSLOVAKIA	365	515	2,300	Poor	Operations prior to World War II partly by private company and partly by government company. Nationalized following war.
POLAND	Privately Owned	Privately Owned	4,105	Fair	Russian Satellite. Nationalized 1946.
IRAN	Privately Owned	Privately Owned	29,235	Excellent Big Area	Nationalized 1951. Private company produced 349,060 barrels daily in 1945 and was producing 700,000 barrels daily when properties were confiscated in 1951.
YUGOSLAVIA	Privately Owned	550	2,745	Poor	Nationalized following war. Italian government company conducted operations from 1940 to end of war.
FRANCE	1,480	555	6,710	Fair	Private companies permitted. However, all production by companies in which French Government owns controlling interest.
ITALY	10	35	1,150	Poor	Both private and government companies operate. Private companies produced in 1935 about 320 barrels daily, 150 barrels in 1945 and 75 barrels in 1952. Private operations hampered by 1927 law denying further concessions to foreign concerns.
ALGERIA	5	10	800	Poor	Private company operations permitted. However, all production by French-Algerian government company.
MOROCCO	10	70	2,075	Poor	Private company operations permitted under restrictions. However, all production is by a French-Moroccan government company.
EGYPT	Privately Owned	Privately Owned	Privately Owned	Fair	1948 law required private companies be owned 51% by Egyptian nations. Private companies have stopped development but continue producing operations, producing 25,767 barrels daily in 1945 and 45,022 barrels daily in 1952.
TURKEY	No Production	No Production	310	Fair	First production 1947. Early in 1953 there were indications Turkey would open oil operations to foreign private companies.
BURMA	Privately Owned	Privately Owned	Privately Owned	Good	Since 1948 limited to government or private companies with majority of Burmese capital.
TRINIDAD	Privately Owned	Privately Owned	Privately Owned	Good	Since 1942 new rights limited to British subjects.
BRITISH BORNEO	Privately Owned	Privately Owned	Privately Owned	Good	Limited to British nationals.
TOTAL: Government companies	508,530	558,125	1,315,200		Despite confiscation of properties developed by private companies in many areas Government owned production has increased only ¾ of a million barrels between 1945 and 1952, of which Russia and Mexico account for over ½ million barrels.
REST OF WORLD: (Private Companies)	4,023,470	6,550,575	10,924,600		Despite loss of valued properties due to nationalization of oil in many areas, production of privately owned companies has increased nearly 7 million barrels daily since 1935 and 4¾ million barrels since 1945.
WORLD	4,532,000	7,108,700	12,239,800		

* Estimated. Data not yet available for 1952.

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Argentina, another heavily endowed oil area, has had a similar dismal record. Current production is only 66,000 barrels daily, about half as much as is consumed. Despite an intense need for more oil, Argentina has failed to double its 1935 producing rate, when private operations were restricted to acreage already held.

Furthermore, a fourth of Argentina's present oil supply comes from the old holdings of private companies.

Argentina's government operations have built up a production of only 52,000 barrels a day since 1935.

Mexico, also blessed with abundant oil, has managed to boost its production to 215,000 barrels a day under government operations. However, this is only double the recovery prior to nationalization in 1938, and still but half of its peak output in 1921 before starting to make excessive exactions on private oil companies.

Moreover, most of Mexico's production today comes from fields discovered by private oil companies; two-thirds comes from the famed prolific Poza Rica field found only shortly before expropriation.

Bolivia has raised its production from only 300 barrels to a mere 1500 barrels daily since nationalizing oil properties in 1937. But practically all this country's production today is from fields found and partially developed by private concerns before being ousted.

Some Doors Open. On the other hand, it is highly encouraging to see some countries moving into positions which will give private business a chance to develop their oil resources. The two latest examples are Peru and Turkey.

After the passage of a new petroleum law which permits the granting of concessions to private interests, Peru has experienced an initial rush of applications. At least 13 companies, including four U. S. organizations, have filed more than 250 separate bids for Peruvian concessions. The same areas are sought by as many as five companies.

With restoration of free enterprise in Peru, budgets are being brought into balance and the country is becoming one of the most stable and prosperous nations in South America.

Acknowledging the failure of governmental efforts to develop its oil resources, Turkey recently announced its plans to seek the aid of foreign private interests. This move may have a salutory effect on other Middle East countries which have been sliding toward nationalization. It may help head off the trend toward seizure of private properties.

In Turkey, when private companies are permitted entrance under mutually satisfactory working agreements, we will see the birth of a substantial setback to Soviet Russia. Situated on the Russian border, Turkey's improved economy under oil exploitation—almost inevitable if oil in large quantities is discovered in areas already respected as favorable—will have an impact on the Iron Curtain.

While Russia can largely prevent information leaking out of its own bailiwick, not even iron-handed Communism will be able to prevent news of Turkey's progress from sifting into Russia.

Given sufficient time, the prosperity of both Peru and Turkey may be substantially improved. Years hence, it will be interesting to compare the progress of petroleum development in Peru and Turkey with some of the nations which have nationalized their oil industry.

Big Risk. To develop a new area's oil potentialities, huge capital investment must be risked. In most cases, years pile up and expenditures mount into the millions before the enterprise starts to payout, granting that oil is discovered in great quantity.

Fundamental risks inherent in discovering new oil and finding a market are staggering. They are not risks which are likely to be taken unless the hope of commensurate reward is great. To make exploration undesirable, a nation need only heap undue political risks upon normal geologic and competitive risks.

The discovery and development of oil is peculiarly adapted to free enterprise. The tremendous risks involved require a venturesome pioneer spirit. Worthwhile financial returns for those who succeed is the means of attracting organizations of this type to the oil business.

History demonstrates that the finding and producing of petroleum are enterprises which do not lend themselves to successful performance by the state. Lacking certain assurance of sufficient rewards, governments are not willing to assume the heavy risks involved in seeking oil on a big scale.

In some cases where governments have seized petroleum resources developed in their countries by private enterprise during the past 35 years, they have been able to expand production from seized properties, rather than through development of new sources. However, no government has succeeded in developing sufficient crude production to fully meet the needs of its own people.

Only those countries permitting private operations have surplus oil to sell have-not nations. None of the many state-operated monopolies makes a significant contribution to the stream of international oil commerce.

The Answer? Only a few instances in which national barriers have begun to dam the world's oil flow have been pointed out here. There are many others. And they all point to a single need—the need for more cooperation and understanding, less coercion of business—if the world petroleum demands are to be met in future years.

Some thought must be given to the factors involved in producing oil, particularly when it is located in jungle or desert areas far from marketing centers. Costs are not identical in all countries. Consequently, all countries cannot or should not expect to have equal profit divisions.

Rules which would best serve to satisfy the world's peace-time needs for oil are simple and few:

> Governments must facilitate and encourage the search for oil by free enterprise through enactment of laws which recognize economic hazards and provide assurance against insecurity of investments. Given conditions which provide proper incentives and stability, private business will make available the required supply of oil which the world will need.

These steps would be a great stride toward permanent peace, toward improved standards of living for many millions, and a damaging blow to Communism.

ACKNOWLEDGMENT

Presented March 24 before annual meeting of American Association of Petroleum Geologists in Houston.

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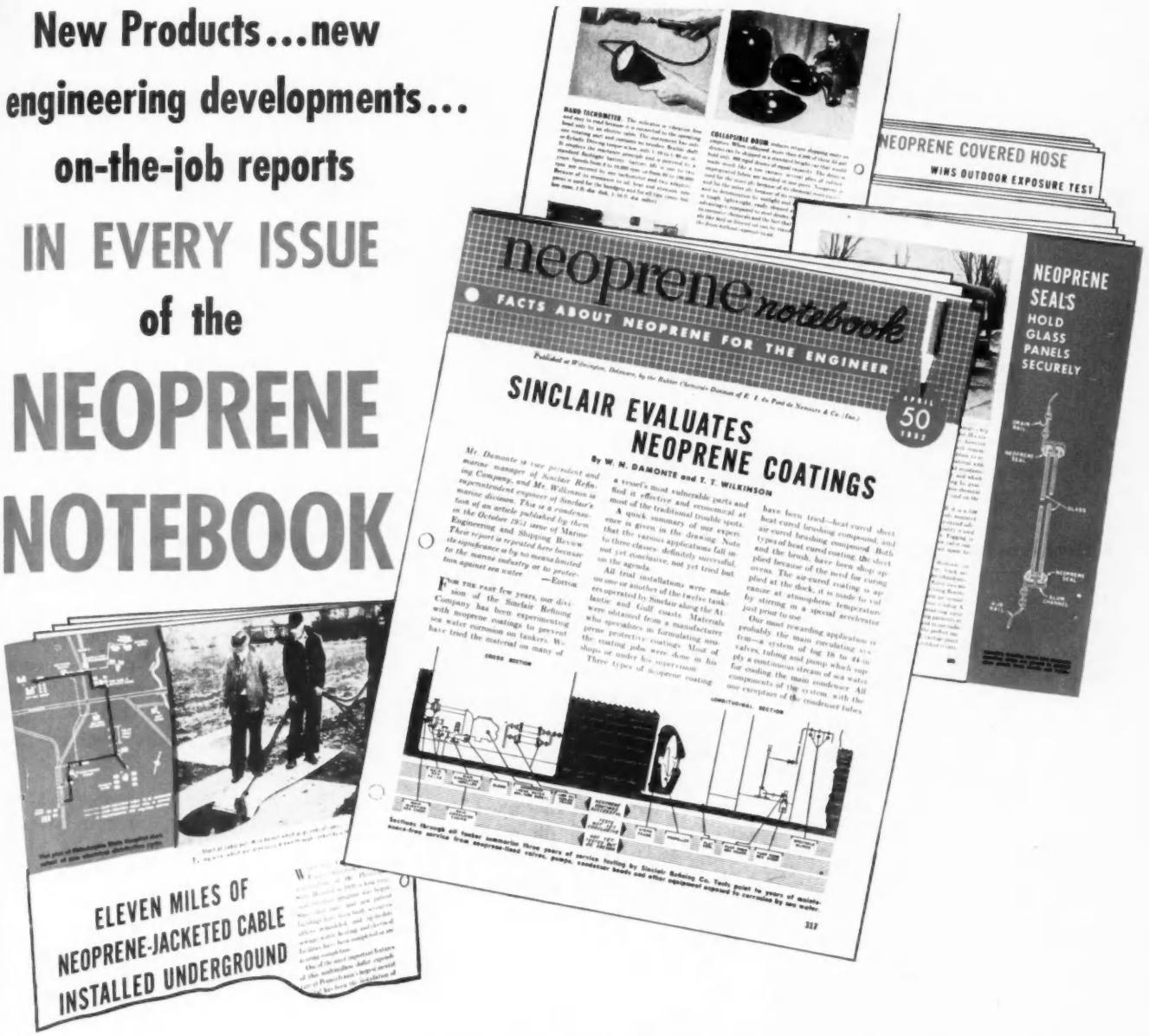
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Fracturing is significant feature of . . .

Spraberry Structural Conditions

Fractures range above 100 feet in vertical length and up to ¼ inch in width.

By G. FREDERICK WARN
Professor of Geology, Texas Technological College, Lubbock

Vertical Fractures. Vertical fracturing is a striking and common feature in the southern part of the Spraberry trend. Gibson[16] reports fractures over 100 feet in vertical extent, although coring in most instances has been insufficient to allow interpretation of the total vertical length of the breaks. Fracture widths are estimated by Lytle and Rieke[23] to range from minus 1/1000 inch to ¼ inch. The various fracture types encountered in Spraberry cores have been illustrated by Brance, Bristol and Helm ([5], Figures 1-4), Senning ([29], p. 128), Stuart ([35], Figure 3) and Ogden and Locke ([28], Figures 3-5).

The fractures from feeder lines which effectively drain the oil from the reservoir matrix into the bore hole. At the same time they allow dissolved gas to bypass the matrix in attaining the bore hole. Completion methods employing water-base muds risk plugging the feeder lines, with gradual to sudden loss in permeability as a consequence. Completion practices in the Spraberry include cable tool rigs, drain hole and high angle drilling, fluid control jet subs in a string of drill pipe, reverse circulation drilling, oil emulsion and oil base mud and crude oil, acidizing, nitroglycerin shooting and formation fracturing processes (see Legendre[22] and Mardock and Myers[24]).

Air drilling is one of the more recent attempts to eliminate the risk of sealing off fractures in the pay zones;[30] (Berry,[2] Berry and Quesenbury[3]). Some wells have experimented with small holes drilled horizontally from the bore hole in order to encounter a greater number of the vertical fractures. The use of high angle and drain hole drilling to intercept greater fracture porosity is described by Carlson.[9] The fracture porosity has been effectively increased in some wells with perforations, explosives and gel fracturing.

One of the latest developments in the fracturing of tight sandstone reservoirs uses variable sized naphthalene pellets as a plugging agent to bridge and seal off old fractures for the purpose of establishing higher hydraulic pressures and creating new fractures (Howard and Bearden[18]). The fracturing fluid is napalm gel or napalm-hydrocarbon gel. The pellets are time-soluble in crude oil and are easily removed from the fracture systems. Repeated fracturing and plugging results in increased production up to 250 percent.

The vertical fractures are surely of post-lithification origin, although the cause (or causes) of the fracturing is not so apparent. The breaks are clean cut and, with few exceptions, produce flat surfaces well defined in two dimensions. Such well defined breaks are rarely preserved in sediments deformed prior to lithification.

None of the fractures examined by the author had been filled with or contaminated by materials of younger unconsolidated sediments. None were associated with crumpling typical of intraformational adjustments in unconsolidated sediments. The fact that some of the fractures extend into shales above the sands denies further the possibility that the strains were suffered prior to lithification.

The fracture surfaces bear no evidence of offsettings, slickensides or steps, hence cannot be considered faults. The lack of core orientation prevented the determination of possible patterns of fracture sets or systems. Two core sections had fractures intersecting at angles of approximately 55 degrees. This angle is greater than would be expected from shearing under tension or compression.

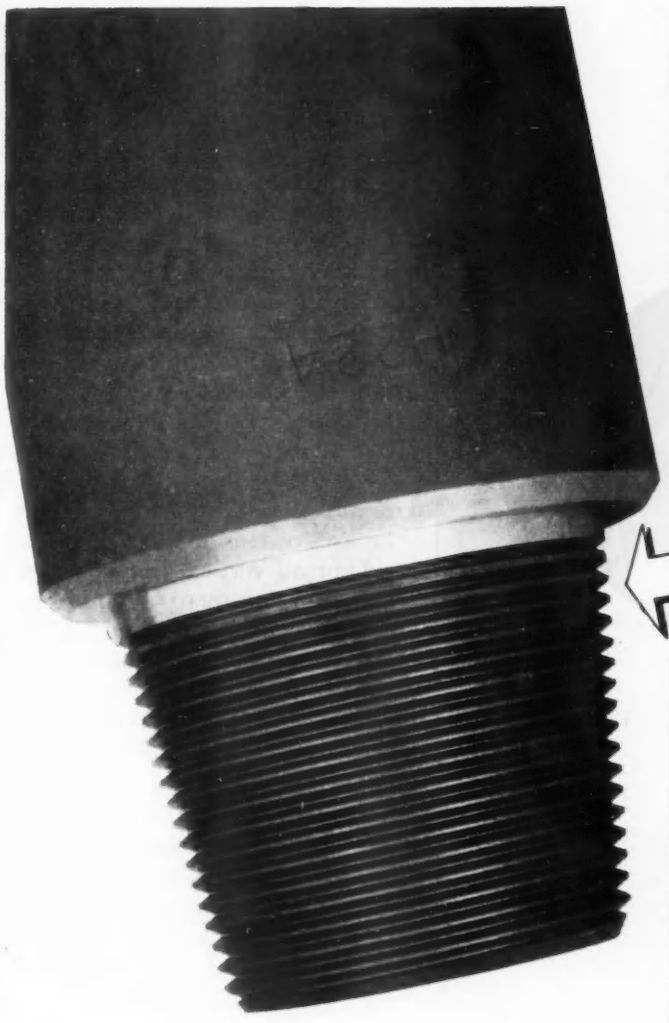
Legendre[22] reports a new method of core orientation with the use of diamond bits. He states that Spraberry sections cored by this method show that most of the fractures are oriented approximately north and south with minor variations to the north-northeast and south-southwest. Stuart[35] recommends diamond coring both for the determination of fracture orientation and for better analysis of reservoir problems involving fracturing.

It seems probable that several factors should be evaluated in attempting to determine the origin of the fractures, namely:

- Nature of the materials.
- Paleoenvironmental conditions during rock failure.
- Nature of the externally applied forces.
- Time.
- Pattern of failure.

The Spraberry siltstones and fine grained sandstones are bonded mainly by siliceous cements and should tend to behave as typically brittle materials. The section, however, is interrupted by shales, limestones, and dolomites which might influence the fracture dips. The deformational environment of confining pressures and temperatures would be determined largely by depth of burial, which in turn would depend on the time (geologic age) of fracturing. The fractured layers are presently overlain by 6000 to 8000 feet of sediments. Assuming an average thermal gradient of 26° C. per thousand feet downward, the minimum temperature environment of the Spraberry would

Part 2



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have been about 182° C. This may have been increased by friction generated during crustal movement.

To these considerations must be added the possibility of interstitial liquids which could have substantially altered the environmental influences. Their over-all combined tendencies would have been to reduce the brittleness of the Spraberry materials. Several types of externally applied force are possible:

- Tension.
- Compression.
- Shear.
- Torsion.

The type of fracture plus the fracture pattern should give some indication of the actual forces involved.

Senning[29] suggests that the fractures are possibly cleavage shears caused by post-Spraberry uplift and subsidence affecting the Midland Basin. This is possible, assuming that the rocks behaved as brittle materials and that the rocks resolved tensile or compressive forces into shearing stresses. Under direct tensile stress, failure by shearing should produce fractures trending normal to the axis of tension and dipping approximately 45 degrees across the same axis. If this axis had been normal to the trend of the eastern edge of the basin (N ±30° W), then fracture sets in brittle materials should strike approximately N 30° W and dip approximately 45° ENE and 45° WSW.

These attitudes would not be altered substantially by the regional dip. Shearing fractures developed in brittle materials under compression would, allowing for friction, develop at angles of 30 to 35 degrees with the direction of stress (Nevin,[27] page 21). Neither of these conditions seems satisfied by the present known attitudes of the Spraberry joints, even allowing for a slight regional dip (7 to 12 feet per mile) to the southeast and a slight local dip (approximately ½°) to the west. No pattern of conjugate shears is evident in the reported fracture trends, although such could be presently masked in the supposed variations from the major trends.

Gibson[16] holds that the movement affecting the section of Permian sedi-

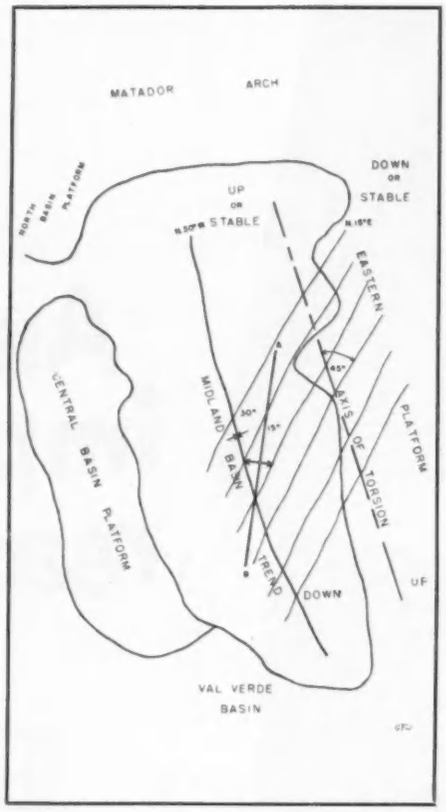

FIGURE 4

Theoretical fracture patterns in the Spraberry trend. Tension fractures produced from the torsion of differential uplift and subsidence should cross the axis of torsion at approximately 45 degrees, the productive trend at 15 degrees and the trend of the basin at 45 degrees. The productive trend (AB) is N-S. The fractures should trend approximately N. 15° E. (Generalized outline of the Midland Basin is drawn at minus 5500 feet mean sea level.)

ments possibly contributed to the fracturing, but was of insufficient magnitude to be the major cause of fracturing. Considering the average depth of burial (±7000 feet) he further states that movement would tend to close such fractures—a condition contrary to the evidence. The present writer points out, however, that the type of forces involved would mainly determine whether the breaks remained open or closed and that the type of fracturing might then operate somewhat independently of depth. Tension should tend to produce open fractures while compression would produce the opposite effect.

It is Gibson's opinion that the open vertical fractures in the Spraberry are due to loss in volume suffered during metamorphism of the shales and laminated siltstones. The time of fracturing is stated to be after burial of the sediments to their present depth. This, for practical purposes, could have been after the close of the Permian since part of the Permian sediments were lost to erosion and were not replaced by an appreciable thickness of younger sediments.

Brittle materials which rupture under tensile stresses generated by loss in volume ordinarily fail less cleanly than in shearing. The fracture surfaces tend to be slightly curving and even somewhat jagged. Shearing tends to produce sharp, clean breaks. Most of the Spraberry fractures tend to show the characteristics of shears in this respect. During sediment shrinkage, a large number of tensile axes operate in horizontal planes, with the resulting ruptures perpendicular to the axes of tension. This would allow widespread vertical fracturing in the Spraberry, but there would be no preferred orientation of the fracture pattern when seen in horizontal plan. Any indication of a definite fracture pattern, either set or system, would tend to discredit rupture by shrinkage.

Gibson[16] further points out that the presence of tight zones of silt between the Upper and Lower Spraberry probably causes separate oil reservoirs. This supposition is substantiated in part by the fact that the gravity of the oil in these two members differs appreciably in some areas.

Carlson[8] in reviewing the "Spraberry symposium," also calls attention to the fact that fracturing by diastrophism is discredited by some observers in favor of shrinkage and/or recrystallization. The abrupt ending of fractures in shales at some of the sandstone and siltstone boundaries is held to support this interpretation. This would assume a greater percentage of shrinkage in the finer grained clastics, i.e., the shales, with little or no effect on the siltstones and sandstones. However, the terminologies of lithologic classification within the Spraberry zones by various writers tends to confuse this approach to fracture origin.

Actually, the forces and conditions causing ruptures in the Spraberry section can, with the presently available data, only be surmised. Differential warping should be considered, particularly because it is in keeping with the sedimentary and tectonic record of the Permian Midland Basin (Warn, Carmack and Sidwell[36]). Differential warping is also a possibility because the productive trend is across the grain of both the Midland Basin

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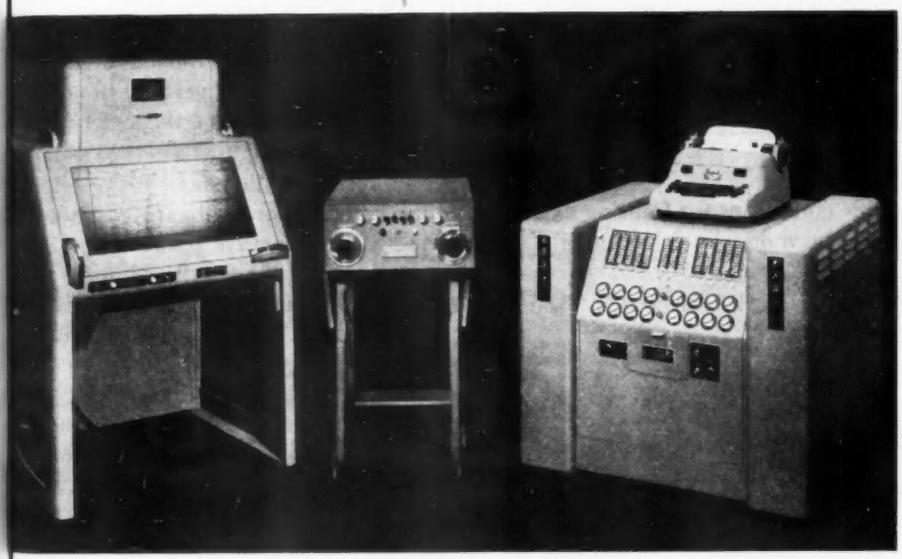

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and the Eastern Platform (Figures 1 and 4).

Post-lithification differential warping of the Spraberry parallel to and on either side of the productive trend could have caused either tensional or shearing ruptures oriented approximately N 45 W or N 45 E. The reported fracture patterns do not bear this out. However, differential warping on opposite sides and ends of the monoclinal trend (N ±30° W) could have resulted in tensile fractures caused by torsion. Assuming an axis of torsion lengthwise of the monoclinal trend, the resulting fractures, theoretically, should intersect the axis at approximately 45 degrees (Nevin,[27] page 151).

This condition would produce fracture sets trending N 75° W or N 15° E, depending on the application of the torques (Figure 4). The N 15° E trend approximates the major deviation from the north-south trend reported by Legendre.[22] Greater uplift on either end of the Eastern Platform, with differential subsidence in the adjacent basin, could have furnished the necessary torques. The fact that fracturing appears limited mainly to the southern part of the trend would tend to indicate that differential warping was more active in this area.

Ruptures caused by torsion in brittle materials frequently result in jagged, helical breaks. Several cores examined contained well developed helical fractures. However, as far as is known, these are of purely local significance.

Subsidence in the basin, accompanied by relative stability or by uplift in the platform, might have produced shearing in a vertical plane (Figure 2B). The resulting ruptures would be caused by tensile stress operating in a plane dipping to the southwest. The fractures should dip about 30° SE. Two conditions are unfavorable to this interpretation:

- The reported fractures are all practically vertical.

- Coupling or shearing stresses during mild flexuring could have been resolved along bedding planes without causing fracturing.

Faults. Significant faulting has not been reported in the productive trend. However it seems probable that two possible conditions for faulting existed during the monoclinal flexuring:

- Tension parallel with the bedding.

- Coupling transverse to the bedding.

Faults of tensile origin could have resulted from the bending and stretching that accompanied the flexuring (Figure 2A). Assuming tensile stress operating in a line perpendicular to the monoclinal trend, the following conditions should be expected during deformation of the Spraberry section:

- The least pressure, greatest elongation, and easiest relief along lines trending WSW x ENE.

- Maximum pressure and greatest shortening in a vertical (upward) direction.

- Intermediate relief and elongation along a line parallel to the strike of the faults. The faults should be of the high-angle gravity type with the hanging wall downdropped relative to the footwall. Such faults should occur near the structurally high part of the monocline and should roughly parallel its trend (Figure 2). The dip probably would be eastward.

High-angle faults might result from couples operating transverse to the bedding (Figure 2C). Basin subsidence, accompanied by stability or uplift in the Eastern Platform would cause the coupling action. The resulting strain can be summarized as follows:

- The long axis (L-L′) dipping westward.

- The short axis (S-S′) representing compressive stress and dipping eastward.

- The intermediate axis (I) in a horizontal plane and striking NW-SE.

- Reverse faults (A-A′) dipping WSW at 55-65 degrees.

Conclusions. In summary, it is obvious that several fracture types occur in the Spraberry: flat vertical breaks; curving vertical breaks; helical breaks; and small intersecting vertical breaks. It is quite possible that the fractures are of multiple origin.

The forces could have been tensional, compressional, shearing or torsional. Major fracture patterns so far reported do not support the interpretation of failure under shearing or compression; neither are tension breaks due to volume loss apparent in the known patterns. It should be remembered that the lithologic materials in the Spraberry section are variable vertically and would not allow homogeneous deformation vertically. The original dips or trends of the fractures could have been altered under repeated deformation, but this does not seem likely in consideration of the Tectonic history of the Spraberry.

Failure by faulting may not have been required during monoclinal flexuring of the Spraberry. If faults do occur, they should be high angle types—either gravity or high angle reverse—and in or near the zone of maximum curvature in the monocline. Gravity types should be dipping eastward, while reverse types should dip westward.

(Second of Two Parts)

A complete list of references was published with Part 1 of this article in the March issue of World Oil.

About the Author

G. FREDERICK WARN, assistant professor of geology at Texas Technological College, Lubbock, Texas, holds A.B. and M.S. degrees in geology from Hanover College and Northwestern University, respectively. He has worked as chief analyst, chemical and physical testing laboratories, Kaiser Company, Inc., in California, and was an aerial photographer for the U. S. Army Engineers during World War II. He holds membership in a number of technical societies and currently teaches structural geology, petroleum geology and geologic interpretation of aerial photos and meteorology.

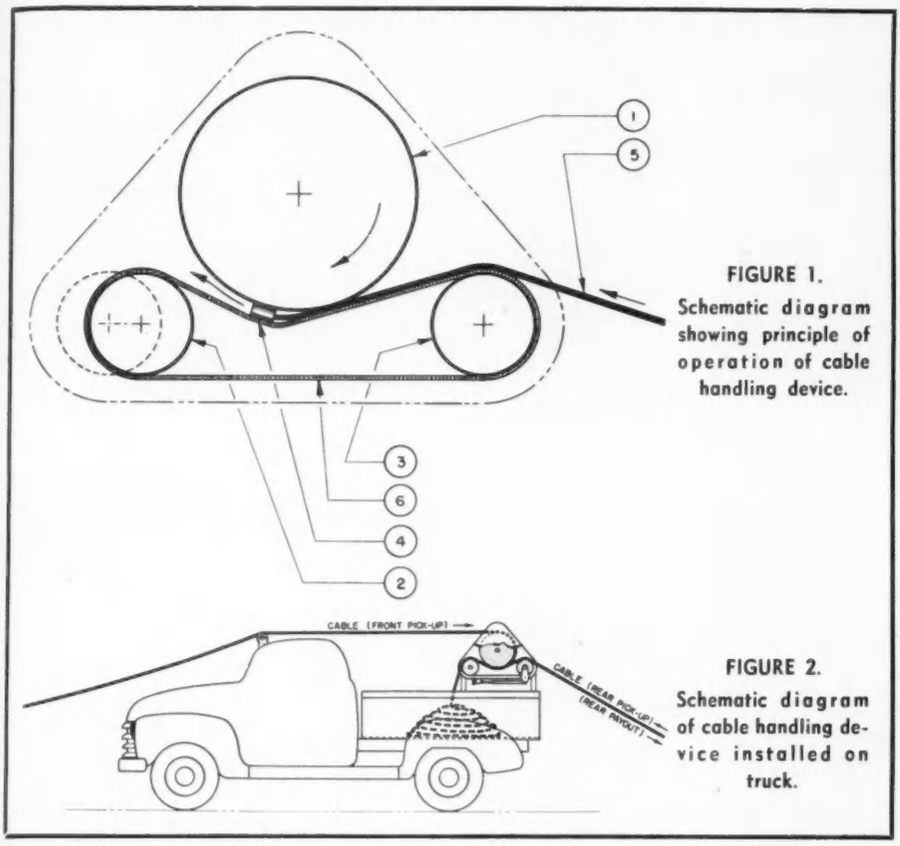


FIGURE 1. Schematic diagram showing principle of operation of cable handling device.

FIGURE 2. Schematic diagram of cable handling device installed on truck.

Cable Handling Device Includes New Features

It's easy to make, flexible and will save time in seismic work.

By JOHN E. ORTLOFF
The Carter Oil Company, Tulsa, Okla.

THE CARTER OIL Company has incorporated a new idea in the design and manufacture of a device for handling seismograph cables. For several years seismograph cables have been handled with reel trucks which pick the cables up from the ground and spool them on a reel. In laying out the cable, the reel clutch is disengaged and the cable spooled off the drum to the ground. Although this method was and is still widely used, it has several disadvantages. Some of the more objectionable features are:

- The equipment is very heavy, is expensive to manufacture and requires fairly complete shop facilities for installation on a truck.
- Because spooling is done manually, the constant attention of the operator is required.
- The inertia of the reel causes damage to the cable if it becomes snagged. The small diameter of the barrel also stresses the cable unduly.

To overcome these difficulties, The Carter Oil Company came up with this new device, which when properly installed on a truck bed will pick up seismograph cable from the ground and deposit it in a random heap in the truck bed. When reversed it will pay out cable from the truck to the ground. Previous field experience in pulling in cable by hand and piling it on the bed of a truck indicated that there was very little chance of the cable becoming entangled. Later laboratory tests proved that the cable will not tangle if it is allowed to fall freely in a pile.

The basic principle of operation is illustrated in Figure 1. As shown, the device includes one large diameter and two small diameter flanged pulleys. A flat belt, the same width as the working face of the pulleys, is wrapped around the two small pulleys, making an arc of contact of approximately 60 degrees with the large pulley. In operation, the end of the cable (5) is inserted between the large pulley (1) and the flat belt (6). The large pulley is rotated as indicated, pulling the cable through the assembly. Small pulley (2) is spring loaded to permit the passage of objects such as plugs (4) and takeouts which are larger than the cable itself. The location of small pulley (3) is fixed, as is the location of large pulley (1). The amount of pull which can be exerted on the cable can be regulated within limits by adjusting the spring tension on pulley (2).

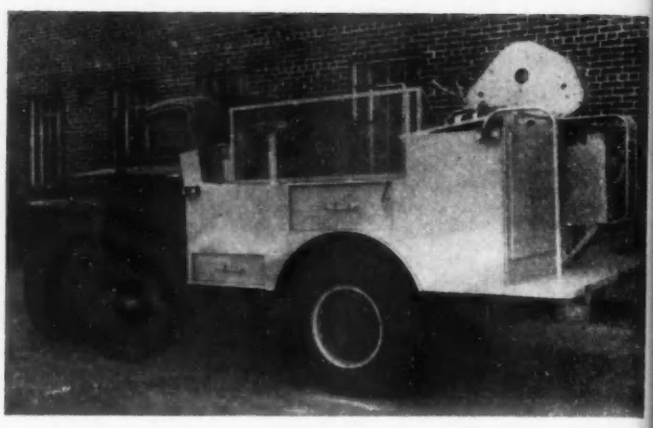
Figure 2 shows how the device can be mounted on a truck so that cable can either be picked up or laid out as desired. It also illustrates how the cable can be picked up from the front over the cab. Direction of rotation of the pulleys is the same for front or rear pickup.

The design and manufacture of the first new seismograph cable handling device was done at The Carter Oil Company's Research Laboratory in Tulsa, Okla. In designing the device, the following objectives were kept in mind:

- The device must be simple and relatively inexpensive to manufacture.
- Weight must be kept to a minimum.
- The mechanism must permit the cable to slip through in case it is caught or snagged, but yet have sufficient pull to pick up the cable and deposit it in a truck bed.
- Flexibility of operation is essential. A variable speed control is necessary.
- Manual handling of the cable when laying out or picking up must be eliminated. The unit must be entirely safe to operate.
- The design must be such that the assembly will be made up as a unit which can be easily installed on any pickup truck, with a minimum of shop time.

In choosing the type of drive to use, it was decided that a hydraulic drive would come closest to meeting the

FIGURE 3.



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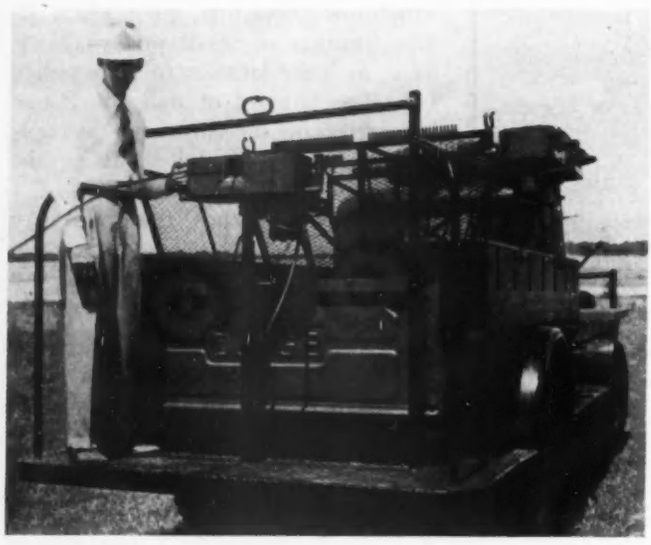

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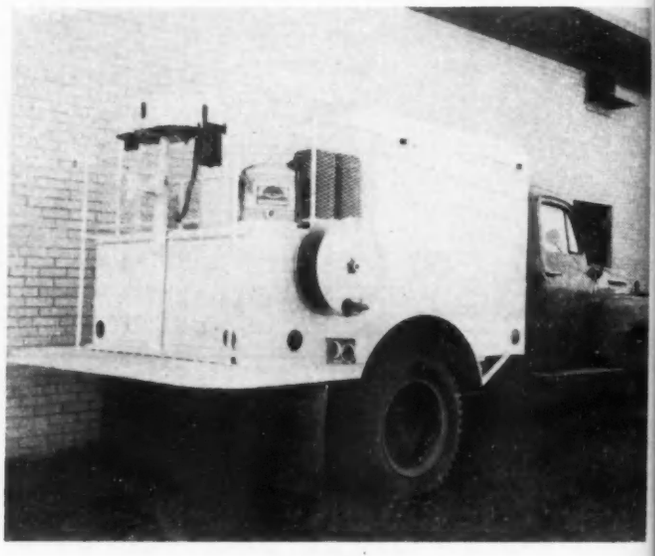


FIGURE 6.

preceding objectives. A hydraulic drive is simple, flexible and will stall without damage to any part of the system. Variable speed control is also easily achieved. Hydraulic systems lend themselves well to unitized design. The hydraulic circuit used in the first unit consisted essentially of a hydraulic motor with a speed reducing gear box for driving the large pulley, a hydraulic pump for driving the motor, a four-way control valve for directional control, a volume control valve for speed control, and a pressure-regulating valve for controlling the amount of pull on the cable.

As previously mentioned, cable pull can be adjusted by varying the spring tension on the flat belt. However, Figure 2 shows that in picking up cables over the cab from the front, the arc of contact between the cable and the large pulley is much greater than it is when picking up from the rear. Thus, much more pull is required to slip the cable through the device when picking up from the front. The hydraulic motor is especially valuable then in front pickup operation since it will stall at a predetermined load thereby limiting the pull which can be applied to the cable.

The front pickup feature of this device is very desirable when working in wooded areas, or where brush or rocks are abundant. In areas such as these the truck can be driven under the cable as it picks up, thus greatly reducing the chances of snagging the cable. Front pickup eliminates the loop in the cable which occurs in rear pickup as the truck is driven beside the cable. The front pickup feature combined with a hydraulic motor which will stall at a predetermined load plus the adjustable belt tension feature makes the chances of damaging the cable very remote.

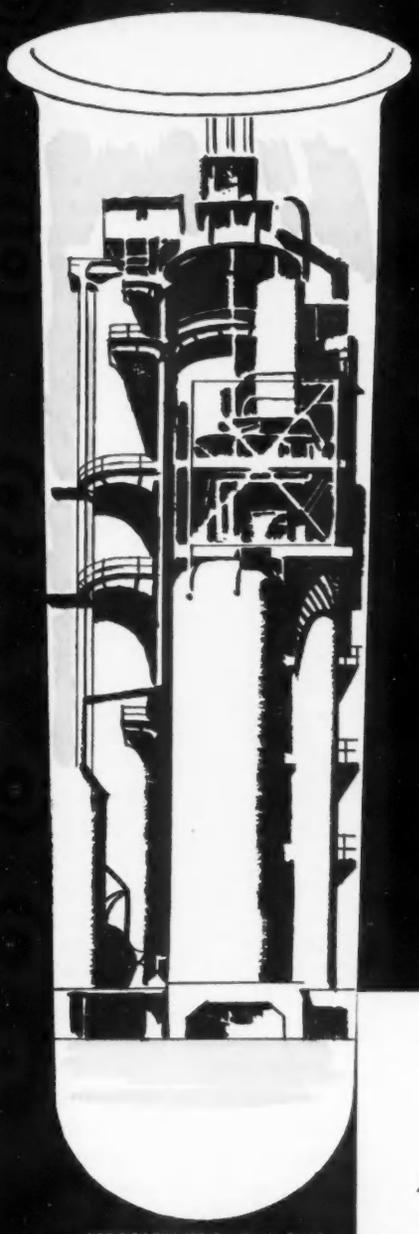
The performance of the first unit was very satisfactory and the unit was received enthusiastically by the seismograph crew. After being in steady use for two and one-half years, this first unit was subsequently transferred, still in good shape, to a new truck. In making the changeover, some changes were made to bring it up to date, but the unit required very little actual repair.

Before manufacturing a second unit, some time was spent in simplifying the design. The result was that a better unit was built at a substantial reduction in cost.

The new hydraulic cable handling device was successful enough that The Carter Oil Company has been replacing the reel type cable trucks with the new device as the reel type cable trucks wear out.

Figure 3 shows the modernized hydraulic cable handling device which resulted from the redesign work done after the pilot model was field tested. Notable improvements over the original unit are:

- Simplification of hydraulic system.
- Simplified mounting and more advantageous location of hydraulic controls.
- Greater storage space for the cables.
- Hydraulic pump driven by power



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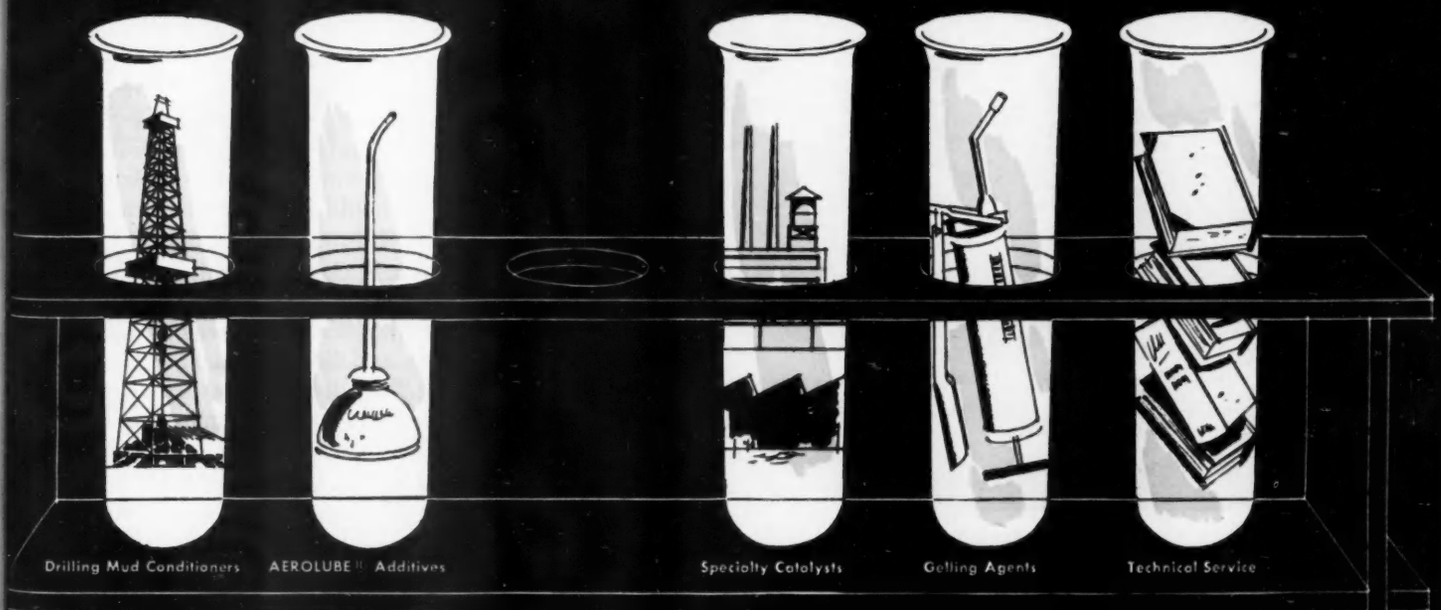

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Because of its light weight, the hydraulic cable handler was easily adapted to installations other than cable trucks. Figure 4 shows a novel application where the device is mounted on a specially designed dynamite truck. This dynamite truck has an expanded metal bin for cables. The cable handling device mounted at the rear permits picking up and laying out cables with a truck which would otherwise be used only for storage of dynamite.

Smaller and Lighter Unit Developed. Because of the success of the hydraulic cable handling device, The Carter Oil Company also developed a smaller unit based on a similar principle. The larger hydraulic unit was designed with sufficient power to pick up cables from the front, over the cab. It was found, however, that much less horsepower was required to pick up cables from the rear than from the front, and since rear pickup can be used in most areas, it was decided to design a smaller and less expensive unit.

In the smaller unit two rubber-tired wheels are mounted so they will roll against each other. An electric starter motor rotates the wheels through a V-belt drive. The cable is placed between the two tires, and pulled through as the tires are rotated. The amount of pull on the cable can be controlled by inflation of the tires. Higher inflation increases and reduced inflation decreases the amount of pull required to slip the cable.

The smaller device can be installed on a pickup truck. Unlike the hydraulic motor on the larger device, the electric starter motor cannot be reversed to pay out cable from the truck to the ground. To permit laying out, the unit is pivotally mounted on the tripod stand so that rotating the unit 180 degrees sets it in position to eject the cable without reversing the motor. Figure 5 shows the device rotated 180 degrees and throwing cable to the ground.

This type of mounting also permits rotating the unit to the desired angle to throw the cable out to the side of the road should the crew be working along a road which carries a fair amount of traffic.

The smaller device, unlike its larger hydraulic predecessor, has no variable speed control. The cable pickup and pay out speed is constant because the motor speed is constant. This does not present any particular problem, however, since in picking up or paying out, the speed of the device is greater than the normal ground speed of the truck, and the amount of cable that is picked up or paid out can be controlled by alternately starting and stopping the electric motor.

The smaller device is particularly valuable because of the vast number of applications it has. It can be used anywhere cables are handled, and requires very little room for installation. One example of the many ways it can be used is shown in Figure 6 where the small cable handler is installed at the back of an instrument truck. A storage bin for the cable is provided for in the installation.

Because of the peculiar manner in which the cable is ejected, the nicknames of "Big Squirt" and "Little Squirt" were tacked on the respective cable handlers by both laboratory and field personnel very soon after their introduction.

Because of its versatility of application, the newer, smaller device proved to be of value in pattern or multiple spread shooting where several cables are used. Figure 7 shows a commercial adaptation in which a cable truck is equipped with five small cable handlers with a cable storage bin for each.

Of the advantages which the new cable handling method has over the old style reel method, safety of operation is certainly one of the foremost. Both types of cable handlers are completely safe. The lower horsepower and the slipping feature of both types make them completely safe even should someone deliberately run a hand through either device.

Patent rights on both types of cable handling device have been assigned to the Standard Oil Development Company and licenses have been issued to one Tulsa firm and two Houston firms permitting them to manufacture and sell both types.

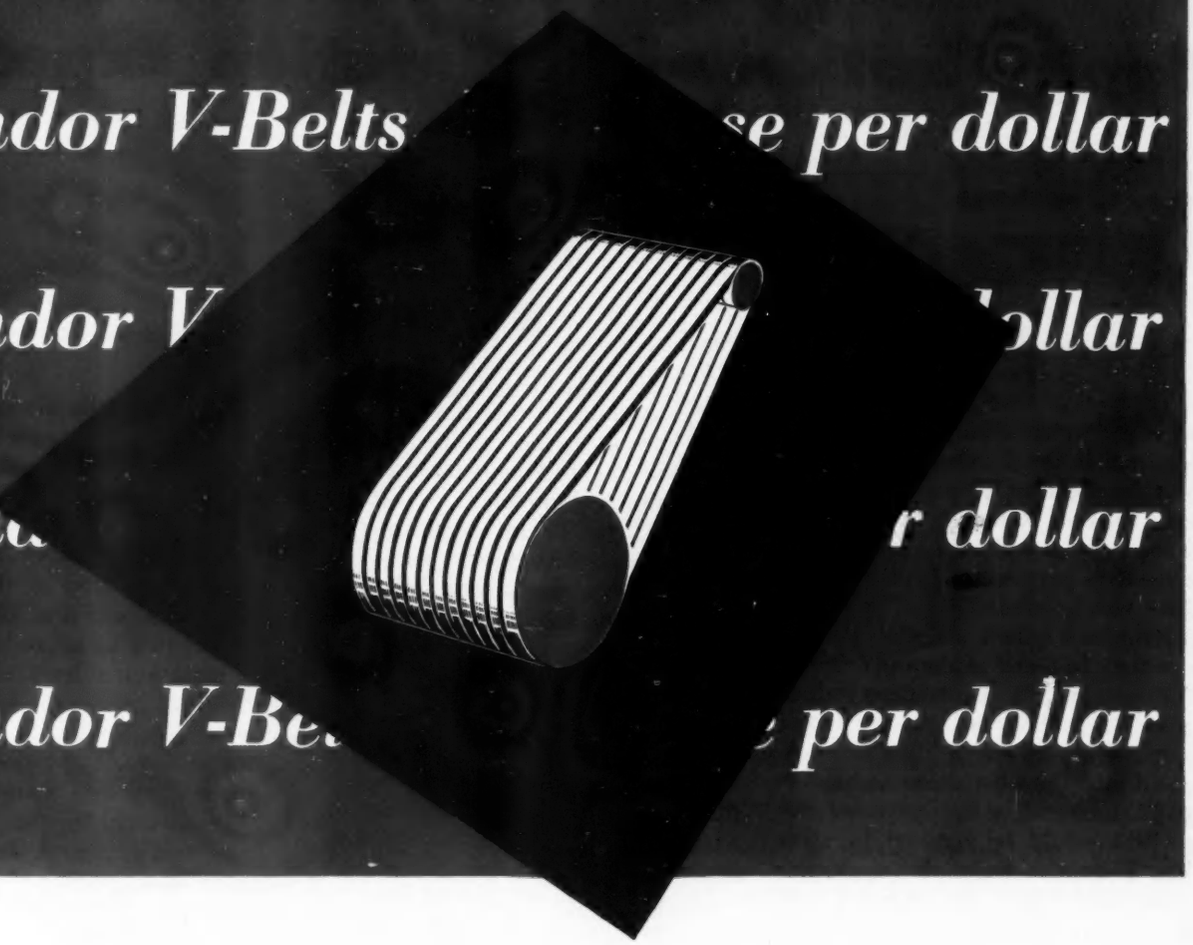
This new method of handling cable should open up many possibilities for time saving in seismograph work.

About the Author

JOHN E. ORTLOFF was graduated in 1940 from Oklahoma A. and M. College, Stillwater, Okla., with a B.S. degree in mechanical engineering. Following graduation he worked with Tulsa Winch Manufacturing Company and later became associated with Franks Manufacturing Company, Tulsa. There he worked as a design engineer for about three years and was then transferred into the research and development engineering section where he assisted in the design and development of several new models of drilling rigs and well servicing units. He joined The Carter Oil Company's research organization in 1948.

FIGURE 7.

Condor V-Belts–More use per dollar



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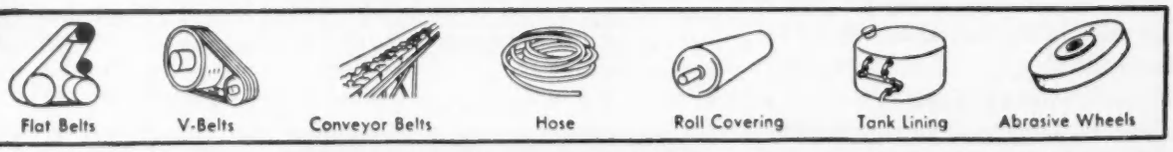

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Are your wildcat ventures based largely on the tax picture rather than actual possibilities of oil or gas? Here's the problem and what can be done about . . . .

Capitalization of Exploration Expenses

By D. L. SHEPHERD
Union Oil Company of California, Los Angeles

CAPITALIZATION OF geological and geophysical expenditures as required by the U. S. Treasury Department has an effect which clearly operates as a deterrent in the search for, and scientific development of potential petroleum reserves. Reason is that capitalization of exploration costs forces the immediate payment of large sums for taxes which, even if returnable at a later unknown date, is not now available for additional exploratory efforts. For example, if a company which spent $2 million on geological and geophysical surveys in 1952 were allowed to deduct the entire amount in its 1952 return, its tax payment due in 1953 would be reduced by more than $1 million from what such payments would be if the geological and geophysical expenditures were capitalized. Thus, in 1953, the company would have available a cash fund of more than $1 million for further exploratory purposes over and above the amount available under capitalization as presently required.

Importance of the development of weak oil plays cannot be over-emphasized at the present time when structures of great promise are becoming increasingly difficult to find. Yet, activity of the small operator to whom many weak plays are frequently farmed out with the help of acreage and cash contributions will be slowed down, not only because of the lack of farmouts, but also because he does not have the cash reserves to carry on exploration work and to pay the current tax costs of capitalization. Moreover, the general application of expensive scientific methods which must be made by large and small companies alike if the hazards of drilling wildcat wells are to be realistically reduced, cannot be afforded in the face of the capitalization requirement.

It is anticipated that the leasing of weak prospects, the drilling of wildcats, and the consequent number of discoveries will be retarded and that emphasis will be on acquiring and retaining only first-class leases in spite of the fact that large quantities of oil have been found on the lower grade prospects. Operations may be expected to be predicted on tax consequences rather than on the basis of the business risks involved.

What are the detailed provisions of this requirement of capitalization and what is its historical background? Moreover, what is being done to alleviate and correct the critical situation, and why is such alleviation and correction vital?

It is important to realize that the concept of oil exploration includes not only geological and geophysical surveys and analyses, but also various types of activities which precede and follow the geological and geophysical exploration. To be sure, geological and geophysical costs comprise the most important single element in terms of money expended; however, scouting and drafting, the necessary clerical assistance and land department functions, laboratory experimentation and analysis, certain supervisory work, as well as supplies consumed and the depreciation, maintenance and repair of equipment used—all of these represent related activities or processes which must be regarded as an integral part of exploration because they contribute to the program of collecting and organizing the data to be used as a basis for acquiring, retaining or surrendering prospective oil and gas interests.

Part 1

Long before the advent of the income tax, it had become the established practice of most oil and gas producers in the U. S. to treat the search for new sources of supply as one of the ordinary and necessary day-to-day features of their business. This was natural and logical, for the only way that an oil and gas producer can maintain a level of production and stay in business is by seeking and finding new sources to replace those being exhausted. Because the cost of exploring for new sources of supply was considered to be recurrent in nature and a part of the normal operation in a producer's year-to-year search for oil and gas, a majority of companies had adopted and generally followed the practice of expensing geological and geophysical costs as well as other exploration costs.

Expenses incurred in actual exploration and related activities have been treated as ordinary current business expenses for financial accounting purposes for many years. Soundness of this practice has been endorsed by many independent public accountants and has been approved by the Securities and Exchange Commission as providing an accurate determination of net income for any particular year. Inasmuch as such expenditures are regularly recurrent, the income for a particular year is never distorted by regarding such expenditures as current operating expenses.

About-Face. Prior to 1942 the U. S. Treasury Department had consistently acquiesced in this well-established practice of the oil industry, although in June, 1941, it published a ruling (G.C.M. 22689) requiring such costs to be allocated to producing properties

PAGES FROM THE LEBUS WIRE LINE SPOOLING HANDBOOK

Cutting Off Is Important to Wire Line Performance

Photograph of one type of dead line clamp recommended so that the line can be slipped through safely and quickly to prepare for making drum end cut-offs when changing the load-lifting position of the wire line on the drum, the crown block and traveling block sheaves.

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to reduce the net income therefrom for percentage depletion purposes—percentage depletion being limited by statute to 50 percent of such net income. This ruling was revoked late in 1941, but the situation with the Treasury Department became worse beginning in 1942, and since that time it has completely reversed its policy of permitting oil and gas producers to deduct all exploration costs as expenses in the year in which paid or incurred. Latest pronouncement of the Department requires that the part of exploratory activities which constitute geological and geophysical surveys must be capitalized.

On April 17, 1950, the Bureau of Internal Revenue published its ruling designated as I. T. 4006, which, in somewhat more detail than the 1942 Field Procedure Memorandum, set forth the requirement of capitalizing geological and geophysical costs.

Memorandum No. 241

The earlier Field Procedure Memorandum No. 241 classified geological and geophysical expenditures into four categories, making no reference to any other types of exploration activities. In general, the first three categories encompassed the expenditures covering the activities which were decisive in the acquisition or surrender of properties. Capitalization was required where the decision was to acquire or retain properties and expensing was permitted where the decision was to surrender or not to acquire properties. The fourth category covered geological and geophysical expenditures incurred in connection with the locating of well sites and the drilling and production of wells. It was provided that these expenditures might be deducted as lease operating or development expenses, assuming as to the latter item a proper election had been made by the taxpayer to expense intangible drilling and development costs. Such expenditures, however, operated to reduce net income for purposes of determining the 50 percent-of-net income limitation on percentage depletion.

A defect of the Field Memorandum is that it failed to define the key word "property" and for this reason, inevitable inconsistencies and practical administrative difficulties, as well as imponderable accounting problems, arose.

In an attempt to answer some of these questions, I.T. 4006 goes into somewhat more detail by defining the word "property," and by discussing the way in which exploration activities may be conducted. Basic principle of the I.T. is that all geological and geophysical expenditures are capital investments. To the extent the expenditures are allocable to properties retained or acquired they must be treated as additional cost of such properties. To the extent they are not so allocable and interest in the area is abandoned they may be written off as a loss.

Property or Lease. In the way of defining the key word property, I.T. 4006 provides that a taxpayer's interest in each separate mineral property is a separate "property" but that where two or more mineral leases are included in a single tract or parcel of land, the taxpayer's interest may be considered to be a "property," provided such treatment is consistently followed. Speaking broadly, the word property may usually be regarded as synonymous with the word lease.

The I.T. then assumes that exploration activities follow a fixed pattern and that one of several factual situations mentioned is bound to develop from the exploration activities. It declares that exploration is customarily conducted by means of "projects," with each project covering only that territory which it has been determined can be explored advantageously as a single integrated operation. It is then stated that after the determination of the area, an inexpensive reconnaissance-type survey is usually made of the entire area, the purpose of which is to locate the portions of the project having the greatest promise, in order to narrow down the boundaries of the original project area into an "area of interest" for detailed exploratory surveys. An "area of interest" is defined as any separable noncontiguous portion of the original project area identified by the reconnaissance-type survey as possessing sufficient potential to merit further exploration.

Where an exploration project is conducted without a preliminary reconnaissance-type survey, the Bureau's ruling provides that the project area and the area of interest are coextensive, but where the areas of interest in an original project area have been located by the so-called reconnaissance-type survey, the ruling provides that the original project area is to be considered subdivided into as many smaller completely independent projects as there are areas of interest for the purpose of allocating and capitalizing the cost of further exploratory work. It is obvious that many variations as a matter of practical fact may develop within the framework of the pattern which the ruling sets forth. For example:

- Only a single area of interest may be located within the original project area. In this case the ruling requires that the entire cost of the reconnaissance-type survey must be allocated to the one area of interest.
- Two or more areas of interest may be identified in the original project area in which case the entire cost of the reconnaissance-type survey must be allocated equally among the various areas of interest and each allocated part of the costs of the reconnaissance-type survey must be treated as a capital expenditure or as a loss, depending upon the final disposition of the area of interest to which the cost has been allocated.
- No areas of interest may be located within the so-called original project area. It is in this instance that the entire cost of the reconnaissance-type survey may be deducted as a loss in the year of abandonment of that particular project.

Having narrowed the capitalization and allocation problems down to the concept of an area of interest, the ruling proceeds to narrow the "area-of-interest" concept down to the "property" actually acquired or retained within such an area of interest, assuming that before such a determination as to acquisition or retention is made, a detailed or intensive survey will be conducted on a particular area of interest. If only a single lease or property, representing a very minute portion of the entire area of interest, is acquired within the area of interest, the entire cost of the reconnaissance-type survey allocated to that area of interest, as well as the entire cost of any detailed survey relating directly to the area of interest, must be capitalized and considered as the cost of such property or lease. If more than one property is acquired in an area of interest, the capitalized cost of the

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reconnaissance and detailed surveys is allocated on an acreage basis. Where no property is acquired or retained within or adjacent to an area of interest, the cost of the reconnaissance survey allocated to that area of interest as well as the cost of any detailed survey may be deducted as a loss in the year in which the area of interest is abandoned as a potential source of production.

The ruling contains no further explanation and does not recognize any exceptions to the pattern of exploration operations which it sets forth. In attempting to gain a better understanding of the practical application of the Bureau's ruling, one may refer to the interdepartmental letter which accompanied the publication of I.T. 4006 when it was distributed to the various district revenue agents in the field, but the purpose of this letter appears to be aimed chiefly at keeping within narrow bounds the application of any exceptions to the fixed and general pattern of the I.T. The letter provides that where a taxpayer retains some acreage on the assertion that it is for his protection only and is not related to the findings of a survey, the writing off of the cost of the survey is to be limited to those cases where the taxpayer can prove by convincing evidence that the property in question was retained in spite of the fact that the geological department recommended the abandonment of all acreage in the area of interest. This requirement imposes an impractical burden of proof.

The only recognition the letter gives to variations from the set pattern of survey operations described in I.T. 4006 is the recognition that an area of a large project may not be definite but may develop pursuant to data gathered. For example, where a company contracts with a survey party for the survey of a large valley extending 75 miles or more with instructions to survey intensively any anomaly discovered by reconnaissance, the letter provides that the cost of any reconnaissance and detailed survey relating to that anomaly constitutes a complete project. The letter provides unrealistically that any further reconnaissance in this large area is assignable to a separate project.

It must be apparent at this point that there are still a great many practical administrative difficulties which may arise and which are not solved by the instructions in the Bureau ruling. Some of these difficulties have been called to the attention of the Bureau and are briefly as follows:

- The problem of determining what particular activities of the exploration operations must be taken into account in connection with the acreage acquired or retained. For example, at what point in the continuous progression from the broadest and most general type of survey to the final step of the most detailed type of survey, must an oil company draw a line between work of a general character, the cost of which is expensible and work which is used in determining whether or not to acquire or to retain acreage, the cost of which work is required to be capitalized.

- The problem of determining what items of cost relating to the actual exploration surveys should be taken into account in a given instance. What portion of the cost of scouting, departmental management, clerical assistance, and other overhead items, should be included and allocated to the actual reconnaissance work being done. This problem also entails keeping the necessary accounting records for each

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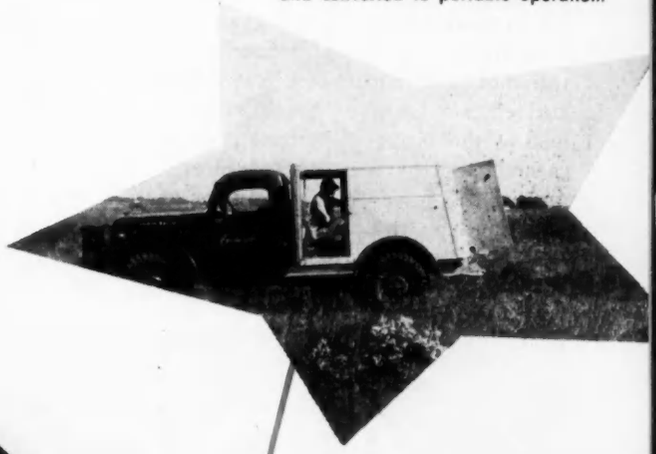

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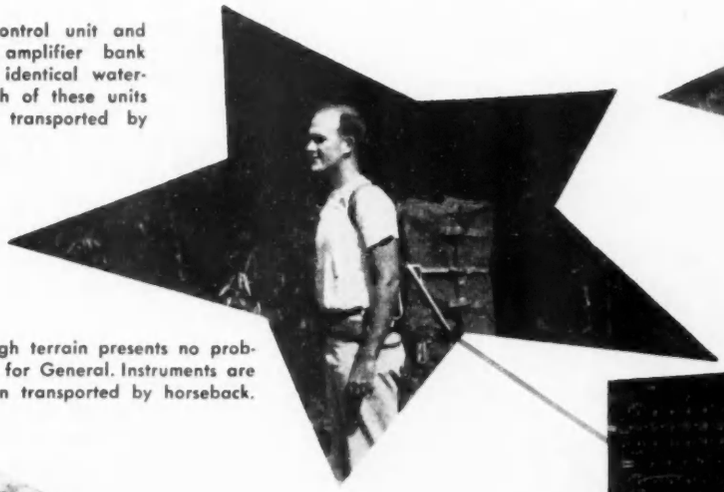
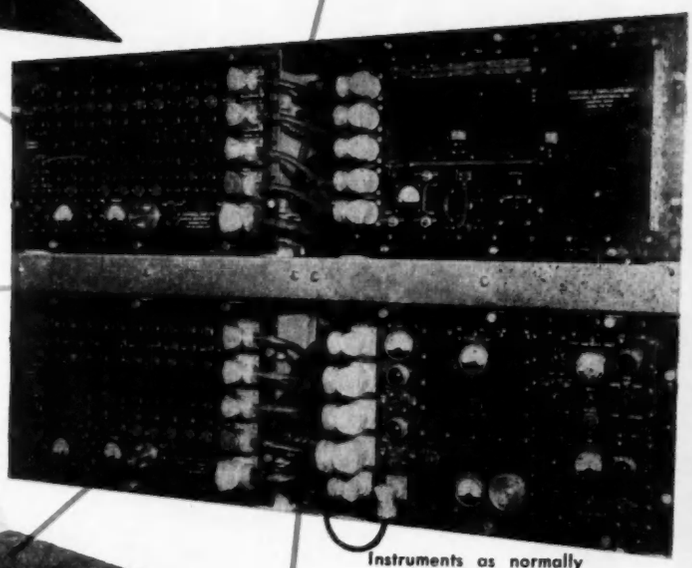


3 Rough terrain presents no problem for General. Instruments are often transported by horseback.



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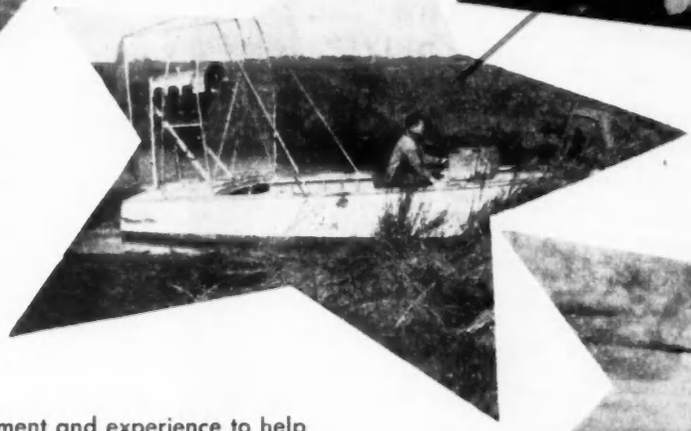

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project and making and maintaining project maps as well as allocating time and work to each such project including some work which is naturally and permissibly expensible and other work which may be direct or supervisory and which must be capitalized. Separation of each feature to be capitalized and each feature to be expensed as well as the proper distribution of the capitalized portion among different projects is involved. Difficulties are magnified by the requirement of accounting for such costs on an annual basis. For example, on those leases which are acquired or retained, it is obvious that some exploration costs are cumulative and the cost of additional work in subsequent years on such projects or leases must be added to those costs capitalized in prior years. Moreover the accurate segregation and accumulation of costs are important in order to show the proper write-off on the cancellation of leases or the abandonment of property.

• The problem of determining precisely the boundaries of a particular project the cost of which must be capitalized in the event property is acquired or retained therein. Some method must be adopted for the determination of the portion of exploration work in a given year that is properly attributable to acreage acquired or retained and the portion that is attributable to other activities. It is easy to establish the requirement that exploration work must be separated into various projects but inasmuch as concurrent surveys frequently overlap and yield contrary results it is extremely difficult, if not impossible, in actual practice to determine under any fixed rule where one geologic survey stops and another begins, or from which of two contiguous surveys the positive evidence resulting in the acquisition of leases was obtained. These practical difficulties have to be reconciled in order to arrive at a reasonable basis for the allocation of exploration work.

• Making the above determinations does not complete the taxpayer's job inasmuch as it is necessary to devote a great deal of time and to have records available to explain each individual determination at the time of the inevitable examination and review of the taxpayer's accounts by the Bureau's engineer revenue agents. No assurance of a finality of determination is possible prior to agreement with the Bureau. It has already been pointed out that the Bureau's agents have differing views as to "the complicated features of I.T. 4006" hence, guesswork and discrimination are to some extent inevitable.

• The earlier mentioned problem of whether exploration expenditures have been incurred for the purpose of determining a well location rather than a possible productive horizon has not been solved by I.T. 4006. This problem arises because when exploration expenditures are incurred for the purpose of determining a well location, they may be treated by a taxpayer as intangible drilling and development costs and may be expensed under the well-established option provisions of the Treasury Regulations. The problem of analyzing the purpose of exploration expenditures in terms of such a classification may not be one of frequent occurrence, yet occasionally oil companies do use seismological information solely to determine the proper location for the drilling of a well where the structure is circumscribed by a prior survey.

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Exploratory Drilling Remains Well Ahead of 1952 Pace

By CECIL W. SMITH, WORLD OIL Staff

EXPLORATORY DRILLING appears to be headed for a successful year from the standpoint of number of wells drilled and the portion to go into the records as successful wells. This, of course, is based on only two months' experience, but for those initial months exploration has accounted for 13.3 percent more tests than were completed in last year's same period and a more important 20.9 percent hike in the number of successful ventures.

So far this year, 1843 exploratory efforts have been completed, as compared with 1626 recorded in last year's first two months. That amounted to a gain of 13.3 percent and also showed an improvement of 1 percent over the lead held at the end of January. This, in a small way, appears to justify the general belief that 1953 will become the greatest exploratory drilling year in history, topping last year's record-breaking activity.

One-hundred-sixty-five exploratory tests, rated as commercial producers of oil or gas, went into the records as the results of February's exploratory campaign that completed 823 tests. Those successes amounted to 20 percent of the total drilled and that was slightly above the average for the year. So far, this year's success measured 19.4 percent while a year earlier the best the industry was able to do was 18.2 percent.

February's results included discovery of 77 new oil finds and 25 new pay levels in older fields for a total of 102 new oil pools. A month earlier, new oil pools totaled 131 to bring the year's total oil finds to 233 or 13.7 percent more than last year's 205.

Natural gas and distillate discoveries totaled 32 in February to bring the year's score to 65 which was an increase of 30 percent over last year's 50 new pools.

Summary of Results of Exploratory Drilling

ITEM	Feb., 1953	Jan., 1953	TWO MONTHS January-February 1953	1952	Percent Diff.
Oil Discoveries	102	131	233	205	+ 13.7
New Fields	77	100	177	152	+ 16.4
New Pays	25	31	56	53	+ 5.7
Distillate Discoveries	6	16	22	15	+ 46.7
New Fields	5	11	16	13	+ 23.1
New Pays	1	5	6	2	+200.0
Gas Discoveries	26	17	43	35	+ 22.9
New Fields	22	15	37	29	+ 27.6
New Pays	4	2	6	6	.....
Total Discoveries	134	164	298	255	+ 16.9
Extensions to Fields	31	29	60	41	+ 46.3
Oil Fields	26	26	52	36	+ 44.4
Distillate Fields	.....	1	1	2	— 50.0
Gas Fields	5	2	7	3	+133.3
Total Prod. Tests	165	193	358	296	+ 20.9
Dry Holes	658	827	1,485	1,330	+ 11.7
Wildcats	648	815	1,463	1,275	+ 14.7
New Pays	.....	.....	.....	1	—100.0
Outposts	10	12	22	54	— 59.3
Total Expl'tory Tests	823	1,020	1,843	1,626	+ 13.3
Percent Productive	20.0	18.9	19.4	18.2	.....
Percent Dry	80.0	81.1	80.6	81.8	.....

Results of Exploratory Drilling in February and First 2 Months, 1953-1952, by Districts

State or District	MONTH OF FEBRUARY, 1953													FIRST TWO MONTHS, 1953															
	Productive Tests									Total Productive	Unproductive Tests			Total Exploratory Tests	Productive Tests								Total Productive	Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions								New Fields			New Pays			Extensions									
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	2 Mo. 1953	2 Mo. 1952	Wildcats	New Pays	Outposts	2 Mo. 1953	2 Mo. 1952	2 Mo. 1953	2 Mo. 1952
Alabama	...	...	...	...	...	...	...	...	...	...	4	...	...	4	...	...	...	...	...	...	...	...	...	...	1	11	...	...	11	3	11	4
Arizona	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	3	...	...	3	...	3	...
Arkansas	1	...	...	3	...	...	...	...	...	4	8	...	...	12	3	...	...	6	...	...	...	...	...	9	7	21	...	...	21	9	30	16
California	1	...	...	1	...	1	...	...	...	3	30	...	3	36	2	...	...	3	...	1	2	...	...	8	15	67	...	7	74	72	82	87
Colorado	2	...	1	...	...	...	...	...	...	3	22	...	...	25	2	...	2	...	...	...	...	...	...	4	3	50	...	...	50	23	54	26
Florida	...	...	...	...	...	...	...	...	...	...	4	...	...	4	...	...	...	...	...	...	...	...	...	...	...	5	...	...	5	1	5	1
Illinois	3	...	...	4	...	...	1	...	...	8	34	...	...	42	3	...	...	4	...	...	7	...	...	14	14	73	...	...	73	53	87	67
Indiana	2	...	1	...	...	...	1	...	...	4	26	...	...	30	4	...	1	...	...	...	1	...	...	6	3	53	...	...	53	59	59	62
Kansas	8	...	1	...	...	...	...	...	...	9	57	...	...	66	24	...	4	1	...	...	...	...	...	29	24	130	...	...	130	129	159	153
Kentucky	1	...	1	...	...	...	...	...	...	2	9	...	...	11	5	...	1	...	...	...	...	...	...	6	3	15	...	...	15	14	21	17
Louisiana	1	1	...	2	...	...	4	...	...	8	28	...	1	37	4	2	...	4	2	...	4	1	1	18	17	68	...	1	69	50	87	67
North Louisiana	...	...	...	...	...	...	2	...	...	2	10	...	1	13	...	...	...	...	...	...	2	...	...	2	9	32	...	1	33	27	35	36
South Louisiana	1	1	...	2	...	...	2	...	...	6	18	...	...	24	4	2	...	4	2	...	2	1	1	16	8	36	...	...	36	23	52	31
Michigan	1	...	...	...	...	...	...	...	...	1	15	...	...	16	3	...	...	1	...	...	1	...	...	5	9	35	...	...	35	32	40	41
Mississippi	1	...	...	1	...	...	...	...	...	2	14	...	...	16	2	...	...	1	3	...	1	...	...	7	7	30	...	1	31	32	38	39
Missouri	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	2	...	...	2	2	2	2
Montana	...	...	1	...	...	...	...	...	...	1	12	...	...	13	1	...	...	1	...	...	...	...	...	2	2	16	...	...	16	9	18	11
Nebraska	3	...	...	...	...	...	...	...	...	3	5	...	...	8	3	...	...	...	...	...	...	...	...	3	3	24	...	...	24	15	27	18
Nevada	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	1	...	...	1	...	1	...
New Mexico	1	...	3	1	...	...	1	...	...	6	16	...	...	22	3	...	4	1	...	...	2	...	...	10	5	31	...	...	31	17	41	22
North Dakota	...	...	...	...	...	...	...	...	...	...	4	...	...	4	...	...	...	...	...	...	...	...	...	...	1	9	...	...	9	...	9	1
Ohio	...	...	...	...	...	...	1	...	...	1	2	...	...	3	...	...	...	...	...	...	1	...	...	1	1	4	...	...	4	5	5	6
Oklahoma	5	1	2	4	...	...	2	...	1	15	52	...	...	67	18	2	2	8	...	...	8	...	1	39	29	114	...	...	114	123	153	152
Pennsylvania	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	1
Texas	46	3	12	9	1	3	16	...	4	94	288	...	6	388	98	12	20	26	4	5	25	...	5	195	149	671	...	13	684	659	879	808
Dist. 1 S. Central	...	...	1	...	...	...	...	...	...	1	25	...	1	27	2	1	1	...	...	...	...	...	...	4	4	53	...	2	55	52	59	56
Dist. 2 Middle Gulf	2	...	...	...	...	...	...	...	...	2	10	...	...	12	5	...	...	1	...	...	...	...	...	6	20	39	...	...	39	47	45	67
Dist. 3 Upper Gulf	2	2	1	2	1	1	4	...	2	15	24	...	4	43	9	4	1	4	2	2	4	...	3	29	16	55	...	9	64	56	93	72
Dist. 4 L. Gulf-S.W.	5	...	8	3	...	2	1	...	2	21	34	...	1	56	9	6	10	6	2	3	1	...	2	39	15	87	...	2	89	68	128	83
Dist. 5 E. Central	...	...	...	...	...	...	...	...	...	...	10	...	...	10	...	...	...	...	...	...	...	...	...	...	2	24	...	...	24	21	24	23
Dist. 6 Northeast	1	...	...	...	...	...	...	...	...	1	9	...	...	10	2	...	...	1	...	...	...	...	...	3	7	24	...	...	24	22	27	29
Dist. 7-B N. Cent.	15	...	1	1	...	...	2	...	...	19	67	...	...	86	30	...	6	7	...	...	4	...	...	47	31	161	...	...	161	135	208	166
Dist. 7-C W. Cent.	7	1	...	2	...	...	1	...	...	11	25	...	...	36	10	1	1	4	...	...	1	...	...	17	15	58	...	...	58	69	75	84
Dist. 8 West	5	...	1	...	...	...	4	...	...	10	22	...	...	32	14	...	1	...	...	...	11	...	...	26	13	49	...	...	49	64	75	77
Dist. 9 North	9	...	...	1	...	...	3	...	...	13	62	...	...	75	17	...	...	3	...	...	3	...	...	23	26	121	...	...	121	116	144	142
Dist. 10 Panhandle	...	...	...	...	...	...	1	...	...	1	...	...	...	1	...	...	...	...	...	...	1	...	...	1	...	...	...	...	...	9	1	9
Utah	1	...	...	...	...	...	...	...	...	1	7	...	...	8	2	...	...	...	...	...	...	...	...	2	...	10	...	...	10	6	12	6
Wyoming	...	...	...	...	...	...	...	...	...	...	8	...	...	8	...	...	...	...	...	...	...	...	...	...	3	20	...	...	20	16	20	19
Total U. S.	77	5	22	35	1	4	26	...	5	165	648	...	10	823	177	16	37	56	6	6	52	1	7	358	296	1463	...	22	1485	1330	1843	1626

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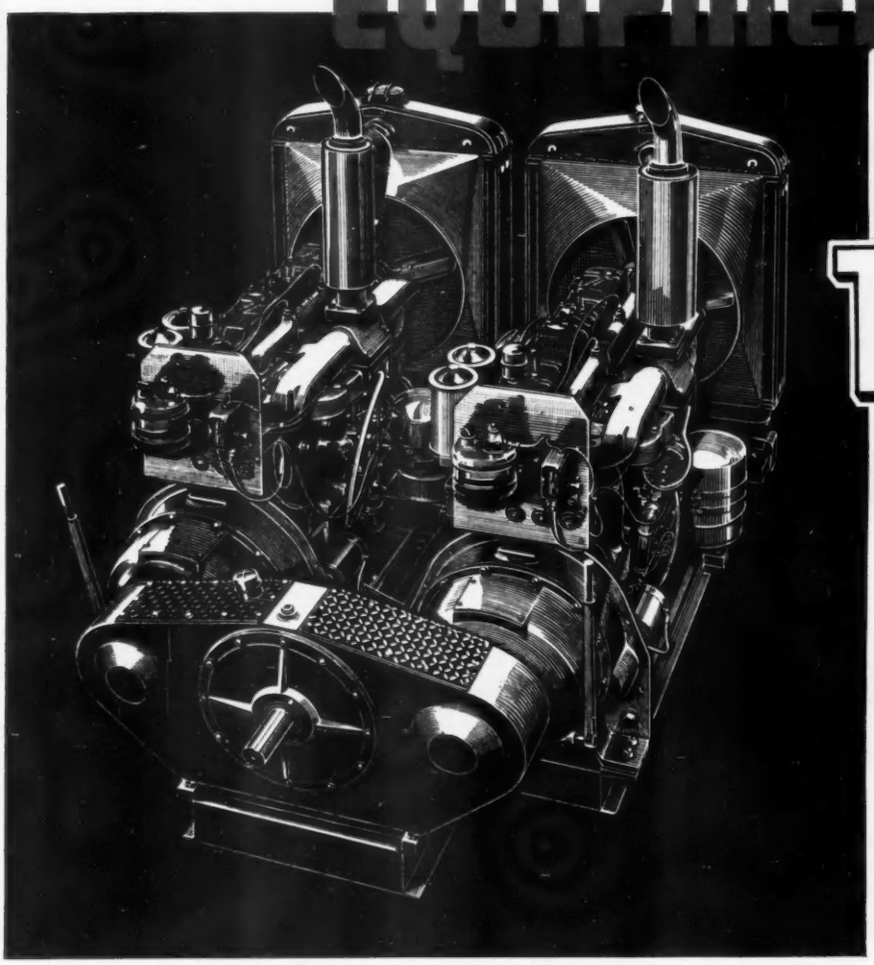

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Continental Motors Corporation
MUSKEGON, MICHIGAN

U. S. Discoveries in February

ARKANSAS—NEW OIL FIELD

Lafayette County, "Midway, West" field. McAlester Fuel Co.'s Clifford McDonald B-1, NE NW 7-15s-24w, flowed 280 barrels from Smackover lime, Jurassic 6569-81 feet, 12/64-inch, 30.9-gravity, completed 2-18-53, TD 6645.

ARKANSAS—NEW OIL PAYS

Columbia County, Springhill field. Hunt Oil Co.'s B. L. Dennis 2, in 11-20s-23w, flowed 221 barrels from Hill (Rodessa) sand, Lower Cretaceous 5025-30, 5052-58, and 5068-75 feet, 43.7-gravity, completed 2-19-53, TD 5984.

Union County, Hibank field. McAlester Fuel Co.'s H. G. Pendleton A-4, C SE SW NW 24-18s-15w, flowed 24 barrels from Tuscaloosa lime, Upper Cretaceous 3054-56 and 3058-60 feet, 10/64-inch, 47.2-gravity, completed 2-8-53, TD 3122.

Hibank field. Murphy Corp.'s Lumber 1, SW SE NE 24-18s-15w, flowed 125 barrels from Hogg sand, Lower Cretaceous 3147-54 feet, 12/64-inch, 45-gravity, completed 2-11-53, TD 3554.

CALIFORNIA—NEW OIL FIELD

Ventura County, Ojai area. Gardon W. Phillips' Bailey 1, in 12-4n-23w, Bard Subdivision, Rancho Ojai, pumped 10 barrels from 798-875 feet, 20.6-gravity, completed 1-31-53, TD 955.

CALIFORNIA—NEW OIL PAY

Ventura County, Tapo Canyon, South field. Terry Drilling Co.'s Tapo 2, in 13-3n-18w, Old Well Drilled Deeper, flowed 700 barrels from Luision sand, Miocene 2370-2507 feet, ½-inch, 35-gravity, completed 2-16-53, TD 3755.

CALIFORNIA—NEW GAS PAY

Madera County, Chowchilla field. Tide Water Associated Co.'s Redman-Stone 1-7, SE SE 7-10s-14e, flowed 5.0 million, 1-inch, completed 2-1-53, TD 2776.

COLORADO—NEW OIL FIELD

Weld County, Roggen area. Twin Oil Corp.'s Cuykendall 2, NW NW SW 12-2n-63w, pumped 106 barrels from Dakota "J" sand, Upper Cretaceous 7018-32 feet, 43.5-gravity, completed 2-9-53, TD 7046.

Unnamed field. South Texas Development Co.'s Leo J. Derks 1, NW NW SE 17-8n-56w, pumped 26 barrels oil and 90 barrels water from Dakota "J" sand, Upper Cretaceous 5923-25 feet, completed 2-2-53, TD 5979.

COLORADO—NEW GAS FIELD

Logan County. H. C. Arnold's State 1, NE NE SW 16-8n-50w, flowed 4.5 million from Dakota "J" sand, Upper Cretaceous 4570-74 feet, ½-inch, completed 2-17-53, TD 4671.

ILLINOIS—NEW OIL FIELDS

Clark County, Melrose field. B. & G. Oil Co.'s O. Wells 1, SW SW SE 13-9n-13w, pumped 10 barrels oil and 1 barrel water from Pennsylvanian sand, Pennsylvanian 839-48 feet, completed 2-17-53, TD 867.

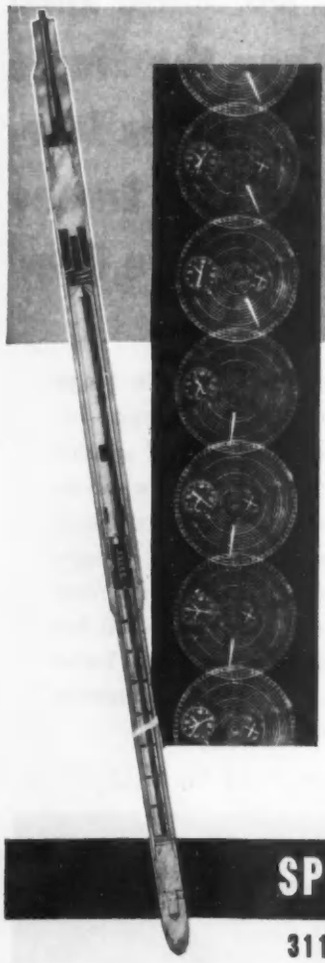
Edwards County, Mills Prairie, North field. Paco Petroleum Co.'s F. Knakmuhs 1, NE NW NW 15-1n-14w, pumped 140 barrels from Lower O'Hara lime, Mississippian 2923-28 feet, completed 2-10-53, TD 3003.

Effingham County, Elliottstown, North field. T. Lindsay's Niemerg-Roepke Community 1, SE SE SE 20-7n-7e, pumped 21 barrels oil and 28 barrels water from Cypress sand, Mississippian 2436-42 feet, completed 2-24-53, TD 2442.

ILLINOIS—NEW OIL PAYS

Edwards County, Ellery, East field. Herndon Drilling Co.'s Cowling Community 1, NW NE NW 34-2s-10e, pumped 102 barrels oil and 10 barrels water from Aux Vases sand, Mississippian 3205-15 feet, completed 2-24-53, TD 3277.

Marion County, Patoka, East field. J. L. Lester's S. A. Clark "D" 1, NW NE SE 34-4n-1e, pumped 18 barrels from Mc-



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Closky lime, Mississippian 1639-47 feet, completed 2-24-53, TD 3078.

White County, Maunie, North field. Ashland Oil & Refining Co.'s & O'Neill's L. Borst 2, SW SW SE 19-5s-14w, pumped 70 barrels from Waltersburg sand, Mississippian 2303-17 feet, completed 2-24-53, TD 2320.

New Harmony Consolidated field. Superior Oil Co.'s H. C. Ford C-8, SW SW SE 27-4s-14w, Old Well Drilled Deeper, pumped 75 barrels from St. Louis lime, Mississippian 3146-52 feet, completed 2-10-53, TD 3794.

ILLINOIS—OIL FIELD EXTENSION

Edwards County, Albion Consolidated field. N. V. Duncan's Maxwell-Mosbarger Community 1, SE NE SE 15-3s-10e, ½-mile extension, pumped 120 barrels from Bethel sand, Mississippian 3012-23 feet, completed 2-17-53, TD 3226.

INDIANA—NEW OIL FIELDS

Dubois County. L. F. Burkhart's Henry B. Hanebutt 1, NW NW SW 9-3s-5w, pumped 50 barrels from Aux Vases lime, Mississippian 838-57 feet, TD 857.

Spencer County. Joe Simpkins' Wyman Bretz Sr. 1, NE SE SW 3-7s-6w, flowed 140 barrels from Tar Springs sand, Mississippian 943-53 feet, TD 953.

INDIANA—OIL FIELD EXTENSION

Pike County, St. Petersburg field. C. E. O'Neal & Co. and John B. Buchman's Nannie Barker Community 1, SE NE NW 32-1n-8w, ¾-mile east extension, flowed 132 barrels from Benoist sand, Mississippian 1312-38 feet, ½-inch, TD 1338.

INDIANA—NEW GAS FIELD

Greene County, Jasonville field. Frank Lyons' Seibert Dyer 1, NW NW SW 12-8n-7w, flowed 1 million from Devonian 1637-1701 feet, TD 1701.

KANSAS—NEW OIL FIELDS

Cowley County. McNeish & Gralapp's Miller 1, NW NW SW 12-32s-5e, pumped 25 barrels from Bartlesville sand, Pennsylvanian 3050-58 and 3060-68 feet, TD 3078.

Ellis County. Lewis Drilling Co.'s Reidel 1, SW SE SW 8-14s-19w, pumped 181 barrels from Arbuckle lime, Ordovician 3839-49 feet, TD 3849.

Pawnee County, Dunes field. Westgate-Greenland's Smith 1, SE SE SW 22-22s-15w, potentialed 2822 barrels from Arbuckle lime, Ordovician 3960-80 feet, TD 4013.

Pratt County, Fitzsimmons field. W. J. Coppinger et al's Fitzsimmons 1, SE SE NW 30-27s-13w, potentialed 1052 barrels from Lansing lime, Pennsylvanian 4058-71 feet, TD 4561.

Iuka-Carmi, South field. Ross & Schaefer's Seidel 1, NE NE NW 19-27s-12w, flowed 426 barrels from Simpson sand, Ordovician 4302-16 feet, TD 4355.

Saline County, Salemsborg, North field. Sterling Drilling Co.'s Miller 1, NE SE SW 32-15s-3w, pumped 124 barrels from Maquoketa dolomite, Ordovician 3392-96 feet, TD 3396.

Stafford County, Diamond field. Petroleum Inc.'s Stewart 1, NW NW NW 8-22s-13w, pumped 100 barrels from Lansing lime, Pennsylvanian 3433-35 feet, TD 3807.

Green Valley field. Westgate-Greenland Oil Co.'s Copeland 1, NW SW SW 2-23s-14w, pumped 140 barrels from Lansing lime, Pennsylvanian 3640-50 feet, TD 4050.

KANSAS—NEW GAS FIELD

Comanche County, Robbins Ranch field. Barbara Oil Co.'s Robbins 1, SE NE NW 23-31s-16w, flowed 6.8 million from Mississippi lime, Mississippian 4888-4930 feet, open, TD 4930.

KENTUCKY—NEW OIL FIELD

Henderson County. H. D. Atha's Mrs. Ewing Williams, Jr. 1, NW NW NW 16-P-22, pumped 45 barrels from Tar Springs sand, Mississippian 1864-75 feet, TD 1875.

KENTUCKY—NEW GAS FIELD

Muhlenberg County, Harps Hill field. J. C. Miller-Ashland Oil & Refining Co.'s Zeigler Coal Co. 1, NE NE NE 22-J-26, flowed 5.4 million from Aux Vases sand, Mississippian 2020-34 feet, TD 2159.

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The Exposition Issue

• If you are unable to attend the 1953 International Petroleum Exposition in Tulsa, the May issue of WORLD OIL will give you a next-best look at exhibits as new as tomorrow.

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NORTH LOUISIANA—OIL FIELD EXTENSIONS

Concordia County, Wildsville field. Barnett Serio's Savage 1, C NE NE 12-7n-6e, ¾-mile north extension, flowed 176 barrels from Wilcox sand, Eocene 5095-98 feet, 9/64-inch, 42.3-gravity, completed 2-3-53, TD 6010.

Webster Parish, Cotton Valley field. Magnolia Petroleum Co.'s Grant-Wadley 2, C NW SE 7-21n-9w, 1½-mile northeast extension, flowed 130 barrels from Pettit lime, Lower Cretaceous 5680-89 feet, 10/64-inch, 51.1-gravity, completed 2-14-53, TD 6012.

SOUTH LOUISIANA—NEW OIL PAYS

Iberia Parish, Eugene Island-Block 45 field. Magnolia Petroleum Co.'s State Lease 834-3C, flowed 595 barrels from 10,290-296 feet, 13/64-inch, 37.3-gravity, completed 2-20-53, TD 11,008.

Plaquemines Parish, South Pass-Block 24 field. Shell Oil Co.'s Louisiana State 998-3, Block 11, flowed 476 barrels from 9091-98 feet, 12/64-inch, 37-gravity, completed 2-3-53, TD 9503.

SOUTH LOUISIANA—OIL FIELD EXTENSIONS

Acadia Parish, Crowley, South field. Kerr-McGee Oil Industries' Hines 1, in 14-10s-1e, east extension, flowed 438 barrels from Lower Miocene sand, 9371-77 feet, 15/64-inch, 33.2-gravity, completed 2-17-53, TD 10,006.

Cameron Parish, Black Bayou field. Shell Oil Co.'s Watkins 81, in 12-12s-13w, northwest extension, flowed 268 barrels from Lower Miocene sand 8012-32 feet, 9/64-inch, 37.0-gravity, completed 1-21-53, TD 8459.

SOUTH LOUISIANA—NEW DISTILLATE FIELD

Acadia Parish, North Mowata area. H. L. Hawkins' Ora Childs 1, in 55-7s-1e, ungauged from 8972-76 feet, completed 2-10-53, TD 9400.

MICHIGAN—NEW OIL FIELD

Van Buren County. Orville Palmer's Chapelle 1, SE SE NW 16-1s-15w, Columbia Township, pumped 25 barrels from Traverse lime, Devonian 1159-62 feet, TD 1162.

MISSISSIPPI—NEW OIL FIELD

Adams County, Anna field. Dave Gammill & Lyle Cashion Co.'s Ida Stowers 1, in 8-8n-2w, pumped 53 barrels from Pearline sand, Eocene 5637-38 feet, 36-gravity, completed 2-4-53, TD 6617.

MISSISSIPPI—NEW OIL PAY

Marion County, Sandy Hook field. Humble's Sandy Hook Gas Unit 24-1, in 10-1n-14e, flowed 105 barrels from Lower Tuscaloosa sand, Upper Cretaceous 9044-48 feet, 1/8-inch, 26-gravity, completed 2-12-53, TD 9093.

MONTANA—NEW GAS FIELD

Fallon County. Fallon County Gas Corp.'s NPRR 1, C SW NW NW 7-5n-60e, flowed 0.5 million from Upper Cretaceous sand 1145-50 feet, completed 2-10-53, TD 1940.

NEBRASKA—NEW OIL FIELDS

Cheyenne County. Chicago Corp. & Republic Natural Gas Co.'s Krueger &

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Ladegard et al 1, E½ NE 31-14n-50w, pumped 181 barrels from "D" sand, Upper Cretaceous 4796-4800 feet, completed 2-17-53, TD 5027.

Kimball County. Forest Oil Co.'s S. N. Marcum 1, NW NW NW 27-13n-55w, pumped 26 barrels from "D" sand, Upper Cretaceous 6242-50 feet, 34-gravity, completed 2-12-53, TD 6560.

Unnamed field. Leon Wondra & W. S. Williams' Allely 1, SW SW NW 1-12n-55w, pumped 146 barrels oil and 36 barrels water from "J" sand, Upper Cretaceous 6209-19 feet, completed 2-21-53, TD 6233.

NEW MEXICO—NEW OIL FIELD

Lea County. Skelly Oil Co.'s Mexico "S" 1, in 23-12s-32e, flowed 533 barrels from Wolfcamp lime, Permian 8600-36 feet, 15/64-inch, 44-gravity, completed 2-18-53, TD 8696.

NEW MEXICO—NEW OIL PAY

Lea County, Caprock, East field. Jake L. Hamon's L. H. Chambers 1, in 1-12s-32e, flowed 528 barrels from Wolfcamp lime, Permian 8400-80 feet, open, 50-gravity, completed 2-17-53, TD 11,385.

NEW MEXICO—OIL FIELD EXTENSION

Eddy County, Cedar Hill field. R. S. Magruder's State 1, in 15-21s-27e, ½-mile southeast extension, pumped 10 barrels from Yates sand, Permian 550-58 feet, 16-gravity, completed 2-10-53, TD 562.

NEW MEXICO—NEW GAS FIELDS

Rio Arriba County. Phillips Petroleum Co.'s Unit (1-3) 29-6, SW NE NE 3-29n-6w, flowed 1.8 million from Mesaverde sand, Upper Cretaceous 5222-6022 feet, completed 1-2-53, TD 6022.

Sandoval County. Albuquerque Associated Oil Co.'s Navajo 1-X, NW NE SE 22-18n-4w, flowed 0.6 million from Mesaverde sand, Upper Cretaceous 965-995 feet, completed 2-23-53, TD 995.

San Juan County, North Chimney Rock area. Southern Union Gas Co.'s Navajo 1-A, C SW SW 36-32n-18w, flowed 13.9 million from Paradox sand, Pennsylvanian 7624-25 feet, completed 2-23-53, TD 8150.

OHIO—OIL FIELD EXTENSION

Coshocton County, Mt. Vernon field. Morrow Oil & Gas Co.'s S. D. Conard 1, Section 13, Perry Township, swabbed 19 barrels from Clinton sand, Silurian 3330-35 feet, completed 2-2-53, TD 3340.

OKLAHOMA—NEW OIL FIELDS

Atoka County. Hal H. Vaughn's Miller 1, NW NE NE NE 26-1n-14e, Old Well Drilled Deeper, pumped 10 barrels from 800-937 feet, 43-gravity, TD 937.

Beaver County. J. M. Huber Corp.'s W. T. Porter 1, C SE NW 26-6n-21ecm, flowed 1008 barrels and 4.0 million from Mormaton sand, Pennsylvanian 5640-94 feet, ½-inch, 39-gravity, TD 5694.

Garvin County. Superior Oil Co.'s Iris Arner et al 1, C NE SE 7-3n-3w, flowed 57 barrels from Hartshorne sand, Pennsylvanian 8335-65 and 8382-8402 feet, 20/64-inch, 50.4-gravity, TD 9375.

Payne County. F. P. Schonwald & Allie P. Reynolds' Nellie Pratt 1, NE NE SW 29-19n-5e, flowed 180 barrels from Red Fork sand, Pennsylvanian 3379-94 feet, ¼-inch, 39-gravity, TD 3756.

Seminole County. Erle P. Halliburton's S. J. Sarkeys 1, SW NE SE 34-7n-5e, pumped 75 barrels oil and 150 barrels water from Simpson dolomite, Ordovician 4060-80 feet, TD 4310.

OKLAHOMA—NEW OIL PAYS

Carter County, Tatums field. Kirkpatrick Oil Co.'s Williams-Gray 8-A, SW SW NE 10-1s-3w, pumped 78 barrels from 1740-76 feet, 26-gravity, TD 1872.

Lincoln County, Chandler field. H. Waggoner & Co.'s Adams 4-A, NW SW SW 15-14n-4e, pumped 60 barrels from Red Fork sand, Pennsylvanian 4218-28 feet, 41-gravity, TD 4228.

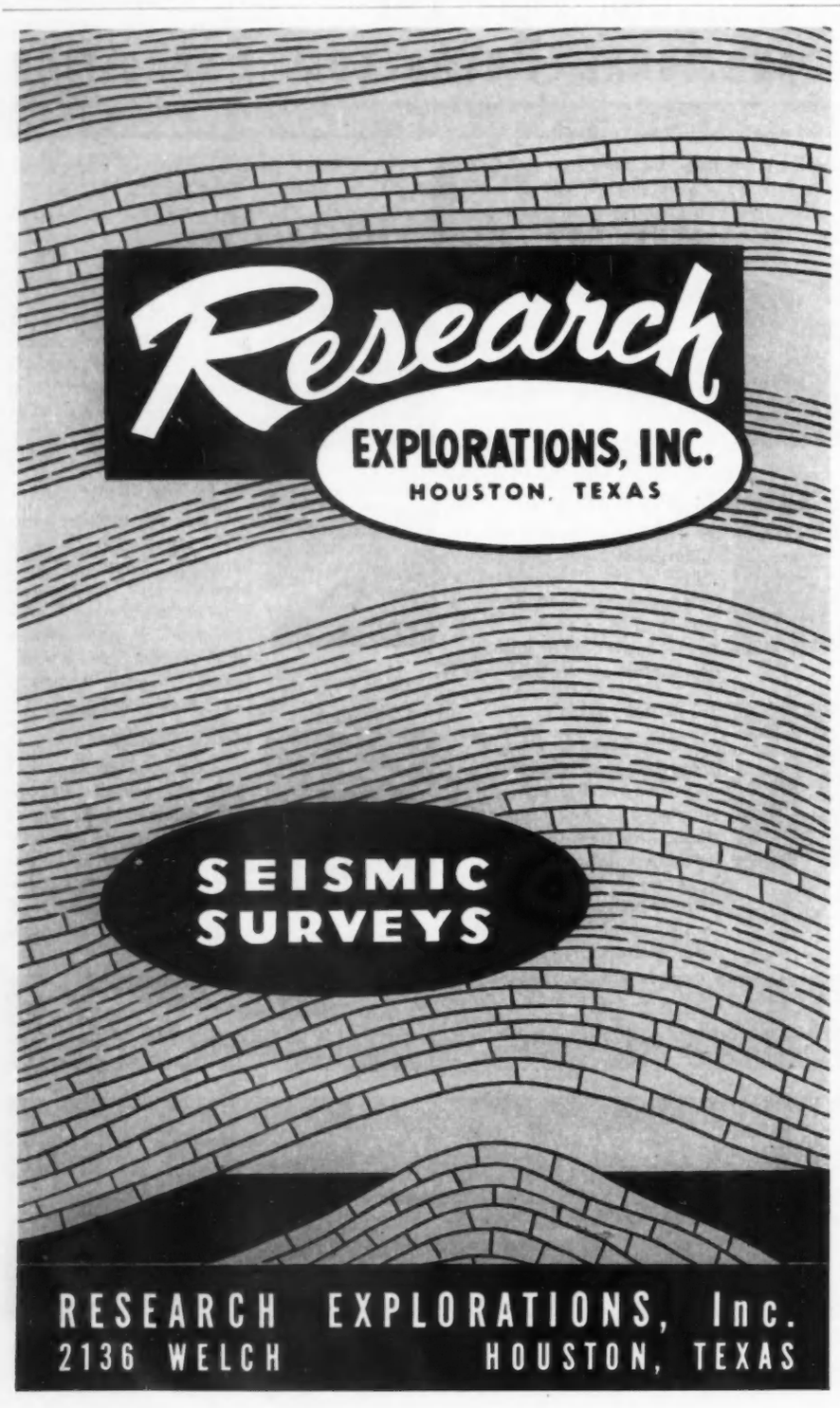
Pawnee County, Hallett field. H. Waggoner & Co.'s Sublett 3, SW SE NW 21-20n-7e, pumped 20 barrels from Lower Skinner sand, Pennsylvanian 2591-2600 feet, TD 2600.

Pottawatomie County, Tecumseh, East field. Davon Oil & Gas Co.'s Spencer 1, NW NW NW 20-9n-4e, Old Well Worked Over, pumped 101 barrels from Hunton lime, Devo-Silurian 4837-60 feet, TD 5309.

OKLAHOMA—OIL FIELD EXTENSIONS

Creek County, Mannford field. Ketchum-Whan Drilling Co. et al's Sidwell 1, SW SW NE 12-18n-8e, 1-mile south extension, flowed 264 barrels from Red Fork sand, Pennsylvanian 2509-21 feet, ¼-inch, TD 2690.

Payne County, Yale field. Gambal Petroleum Co.'s Simnett 1, SE NE NW 9-19n-6e, northeast extension, flowed 37 barrels from Lower Skinner sand, Pennsylvanian 3039-55 feet, TD 3055.



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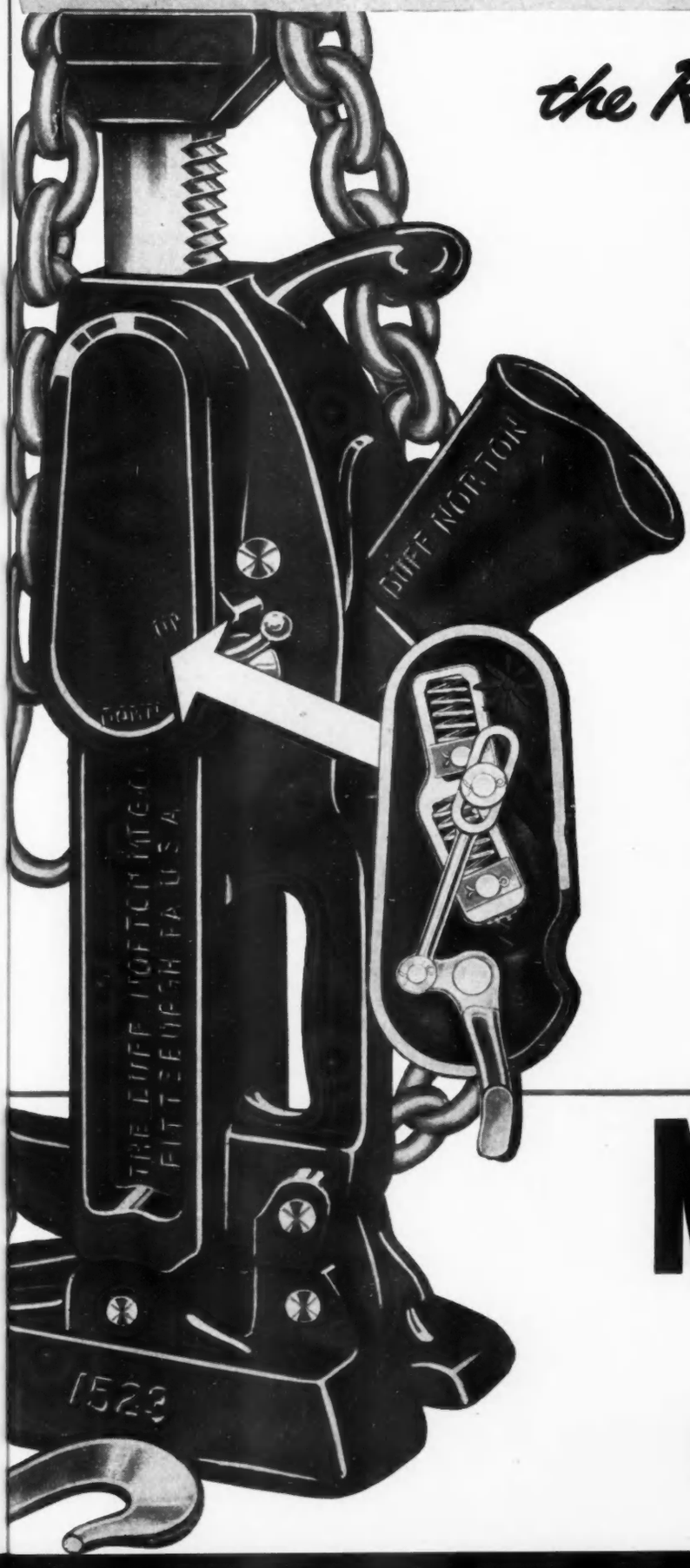

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OKLAHOMA—NEW DISTILLATE FIELD

Pottawatomie County. T. T. Eason & Rockhill Oil Co.'s Forest Anderson 1, NE SE SW 3-11n-2e, flowed 161 barrels distillate in 5½ hours and 9.0 million from Misener sand, Mississippian 5568-74 feet, ½-inch, 57.5-gravity, TD 5675.

OKLAHOMA—NEW GAS FIELDS

Caddo County. Magnolia's F. A. Niles 13, SW NW NW 36-6n-10w, flowed 2.2 million from Upper Melton sand, Pennsylvanian 5066-80 and 5089-5104 feet, open, TD 12,005.

Cimarron County. Coltexo Corp.'s C. J. Purdy 1, C NW SE 20-6n-9ecm, flowed 33.6 million from Morrow sand, Pennsylvanian 4240-53 feet, TD 5020.

OKLAHOMA—GAS FIELD EXTENSION

Lincoln County, Sandy Land field. Service Drilling Co.'s Jones 1, NE SE NW 34-17n-3e, flowed 6.0 million from Lower Skinner sand, Pennsylvanian 4070-82 feet, TD 4082.

TEXAS DISTRIST 1—NEW GAS FIELD

Zavala County. Shell Oil Co.'s H. C. Plumley 2, GC&SF RR Survey No. 3, flowed 22.0 million from Navarro sand, Upper Cretaceous 2270-97 feet, completed 2-5-53, TD 3726.

TEXAS DISTRICT 2—NEW OIL FIELDS

Calhoun County. Humble Oil & Refining Co.'s State-Lavaca Bay Tract 9-1, flowed 165 barrels from Frio sand, Oligocene 7138-42 feet, ⅛-inch, 45.2-gravity, completed 2-10-53, TD 9205.

Jackson County. Salt Dome Oil Corp.'s L. G. Hodge 1, I&GN RR Co. Survey, Section 35, Block 1, flowed 45 barrels from Upper Frio sand, Oligocene 5635-36 feet, ⅛-inch, 26.3-gravity, completed 2-21-53, TD 8450.

TEXAS DISTRICT 3—NEW OIL FIELDS

Fayette County, Elm Grove area. Hamman Oil & Refining Co.'s S. H. McCrorey 1, William Kuykendall ⅓ League, flowed 54 barrels from Wilcox sand, Eocene 1886-96 feet, 12/64-inch, 20-gravity, completed 2-1-53, TD 2030.

Wharton County. Trans-Tex Transmission Co.'s Frank Socha 1, WCRR Survey, Section 39, flowed 72 barrels from Frio sand, Oligocene 4545-48 feet, 6/64-inch, 26.2-gravity, completed 2-18-53, TD 5415.

TEXAS DISTRICT 3—NEW OIL PAYS

Hardin County, Arriola area. Shell Oil Co.'s Kirby Lumber Corp. Tract 17-B-1, Ignacio Villegas Survey, ⅘-mile west of production, flowed 13 barrels from Yegua sand, Eocene 8985-9011 feet, ¼-inch, completed 12-31-52, TD 9641.

Washington County, Arthur Harvey field. Tex-Harvey Oil Co.'s Kuebe Estate 2, S. F. Austin Survey, flowed 227 barrels from Wilcox sand, Eocene 8600-06 feet, 11/64-inch, 41-gravity, completed 2-7-53, TD 9452.

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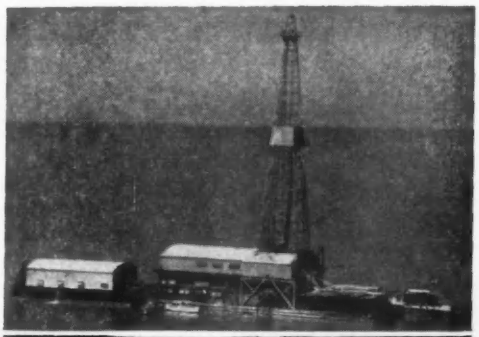

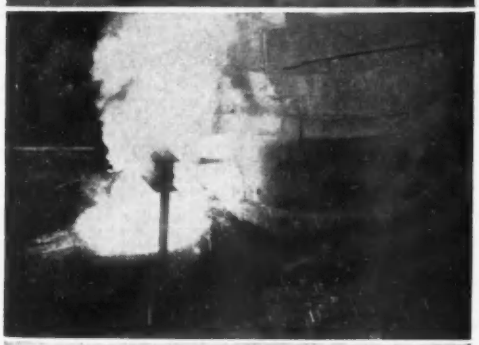

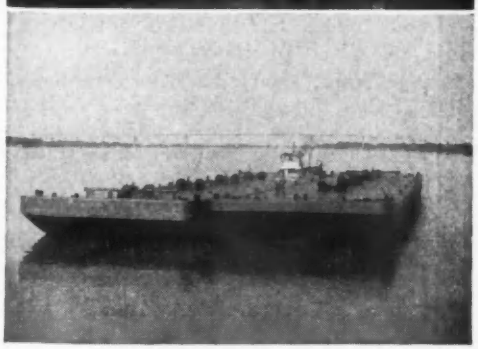

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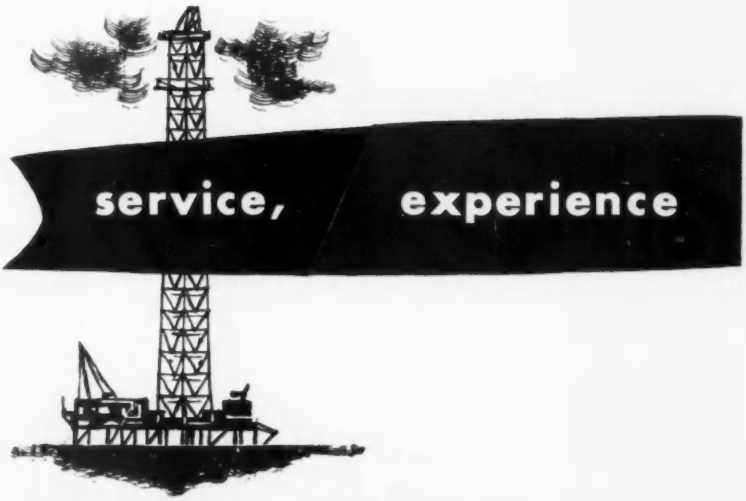

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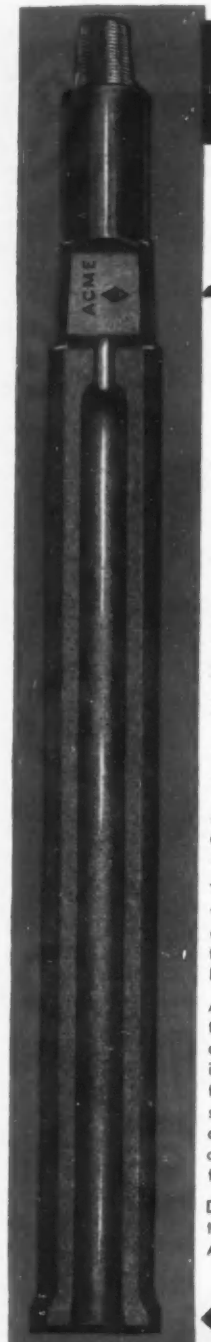

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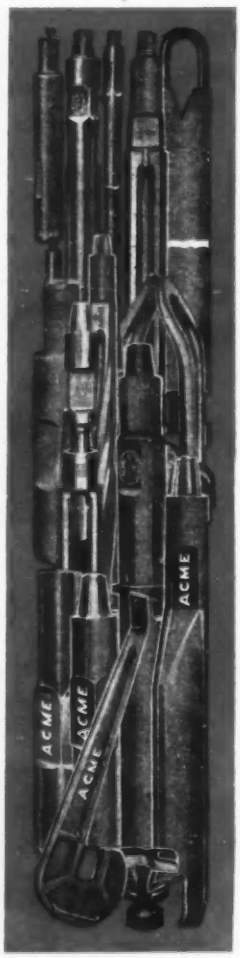

TEXAS DISTRICT 3—OIL FIELD EXTENSIONS

Brazoria County, Danbury field. Humble's Henrietta J. Vrazel "B" 1, J. M. Hayes, ½-mile southeast extension, flowed 335 barrels from Lower Frio sand, Oligocene 8706-14 feet, ¼-inch, 32.5-gravity, completed 2-17-53, TD 12,454.

Chambers County, Trinity Bay field. Humble's Galveston Bay State "F" 22, Galveston Bay Section 29-B, ¾-mile northeast extension, flowed 127 barrels from Frio sand, Oligocene 8105-07 feet, 36-gravity, completed 2-25-53, TD 8600.

Hardin County, Hampton, South field. American Republics Corp. & Houston Oil Co.'s Henry Binns Fee 6, Henry Binns League, ¾-mile west extension, flowed 84 barrels from Yegua "B" sand, Eocene 7100-05 feet, 8/64-inch, 39.0-gravity, completed 2-6-53, TD 8500.

Harris County, Deckers Prairie, South-Segment "A" field. K. & H. Operating Co.'s Otto Siedel 1, C. D. Cranshaw Survey, ¾-mile southeast extension, flowed 166 barrels from Yegua sand, Eocene 5528-31 feet, 8/64-inch, 40.1-gravity, completed 2-7-53, TD 5743.

TEXAS DISTRICT 3—NEW DISTILLATE FIELDS

Colorado County. Sherwood & Blohm's Helen R. Van Werden 1, GH&H RR Co. Survey, Section 21, Old Well Worked Over, flowed 27 barrels distillate and 1.7 million from Yegua sand, Eocene 6390-95 feet, 16/64-inch, 57.4-gravity, completed 1-5-53, TD 6429.

Liberty County. Hassie Hunt Trust's E. W. Boyt, et al 1, J. A. Bellar Survey, flowed 3 barrels distillate and 0.3 million from Frio sand, Oligocene 8494-8503 feet, ⅛-inch, completed 12-19-52, TD 8603.

TEXAS DISTRICT 3—NEW DISTILLATE PAY

Wharton County, Crescent field. Commercial Petroleum & Transport Co.'s Pauline Hejl 1, G. W. Reynolds Survey No. 66, flowed 10 barrels distillate and 23.0 million from Frio sand, Oligocene 5124-31 feet, open, 36.2-gravity, completed 2-17-53, TD 5791.

TEXAS DISTRICT 3— NEW GAS FIELD

Fort Bend County, Long Point Dome field. Goldrus Drilling Co.'s G. W. Trone 1, H&TC RR Co. Survey, Abstract 238, Section 67, ungauged from 5234-44 feet, completed 2-24-53, TD 6330.

TEXAS DISTRICT 3—NEW GAS PAY

Liberty County, Quinn field. Sohio Petroleum Co.'s Foster Lumber Co. 1, T. S. Foster Survey 158, flowed 46.0 million from Cockfield "A" sand, Eocene 6230-45 feet, open, completed 1-17-53, TD 7392.

TEXAS DISTRICT 3—GAS FIELD EXTENSIONS

Jefferson County, La Belle field. Sun Oil Co.'s Broussard & Hebert 22, A. Hotchkiss League, ½-mile east extension, ungauged from 9824-40 feet, completed 2-25-53, TD 9247.

Wharton County, West Bernard field. BBM Drilling Co.'s J. D. Hudgins 1, A. Swartz Survey, Section 40, ⅝-mile west extension, ungauged from Yegua sand, Eocene 7660-7775 feet, completed 12-9-53, TD 7850.

TEXAS DISTRICT 4—NEW OIL FIELDS

Kenedy County. Sun's Laguna State "A" 232-1, Subdivision of Laguna Madre State Tract 232, flowed 152 barrels from Marginulina sand, Oligocene 7280-7315 feet, open, 48.1-gravity, completed 2-27-53, TD 7341.

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The Exposition Issue

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Nueces County. Republic Natural Gas Co.'s Chapman Ranch 1-81, Laureles Farms Tract, Section 81, flowed 10 barrels oil and 4 barrels water from 4304-07 feet, ⅛-inch, completed 1-23-53, TD 6425.

San Patricio County, "Section 2" field. The Superior Oil Co.'s Minnie S. Welder 2-1, C. J. Francisco & E. Portilla Survey, Section 2, flowed 86 barrels from Frio sand, Oligocene 5688-96 feet, 7/64-inch, 38.2-gravity, completed 2-19-53, TD 7754.

Unnamed field. Phillips Petroleum Co.'s "Flinn A"—Mrs. Sallie Flynn 1, Pauls Subdivision of Coleman-Fulton Pasture Subdivision, Section 55, flowed 218 barrels from Frio sand, Oligocene 7185-92 feet, 5/32-inch, 42.7-gravity, completed 2-13-53, TD 8843.

Starr County. George R. Brown's Flavio Canales 1, La Sacatosa Grant, Share 4, flowed 94 barrels from O'Hearn sand, Eocene 2266-77 feet, 12/64-inch, 32.0-gravity, completed 2-19-53, TD 2277.

TEXAS DISTRICT 4—NEW OIL PAYS

Hidalgo County, Donna field. Sinclair Oil and Gas Co.'s Schuster Unit 1, Alamo Land & Sugar Co. Subdivision, Lot 10, Block 13, flowed 71 barrels from Frio sand, Oligocene 6954-64 feet, ¼-inch, 45.0-gravity, completed 2-4-53, TD 8203.

Jim Wells County, Magnolia City, North field. H. R. Smith's Nina Adams Estate 2, Los Presenos Grant, flowed 81 barrels and 0.3 million from Vicksburg sand, Oligocene 4981-86 feet, 6/64-inch, 38.0-gravity, completed 2-14-53, TD 5490.

Kleberg County, Borregas field. Humble's King Ranch-Borregas 93, Santa Gertrudis Grant, flowed 81 barrels from "D-3" sand, Oligocene 4842-48 feet, ⅛-inch, 44.4-gravity, completed 2-11-53, TD 7300.

TEXAS DISTRICT 4—OIL FIELD EXTENSION

Jim Wells County, Alfred field. L. R. Sayers, Charles Daubert & Walter Achning's Bernard Adams 1, L. S. Adams Survey No. 22, Block 19, Waldron Subdivisison, ⅔-mile northeast extension, flowed 75 barrels from Alfred Deep sand, Oligocene 5367-71 feet, 43.7-gravity, completed 2-7-53, TD 5415.

TEXAS DISTRICT 4—NEW GAS FIELDS

Brooks County. Natural Gas & Oil Corp.'s Huffsmith-Cannon 1, Lot 9, Block 8, Burton & Danforth Subdivision of La Parrita Ranch, ungauged from 7408-20 feet, completed 2-19-53, TD 8318.

Duval County. Don H. Marsh, et al's Otilio Garcia de Olivarez 1, "Santa Cruz de la Concepcion," Francisco Cordente, Share 7, flowed 2 million from 1250-54 feet, open, completed 1-5-53, TD 3604.

Unnamed field. Sid Katz's Altha G. Block 2, G. Huggins Survey 6, flowed 0.8 million from Pettus sand, Eocene 4479-81 feet, open, completed 2-20-53, TD 4485.

Hidalgo County, Klump field. Taylor Oil & Gas Co. & Mayfair Minerals Inc.'s B. F. M. Klump 2, Portion 70, flowed 1.5 million from 9754-64 feet, ¼-inch, completed 2-23-53, TD 10,293.

Jim Wells County, Bailey field. Lyman-Damascus Operations' Rolsten 1, R. King Farm Lots, Section 17, flowed 26.0 million from Kohler sand, Eocene 5784-88 feet, open, 62.0-gravity, completed 2-6-53, TD 5950.

Unnamed field. L. O. Kelsey's Mrs. Florence Ragland 4, Los Presnos de Abajo Grant, Section 3-A, C. W. Ragland Subdivision, Old Well Drilled Deeper, ungauged from Pundt sand, Oligocene 5000-12 feet, completed 1-30-53, TD 5060.

Kenedy County, Murdock Pass field. Sun's Laguna State "B" 237-1, Subdivision Laguna Madre Tract 237, flowed 8.5 million from Marginulina sand, Oligocene 7304-22 feet, ⅜-inch, completed 2-6-53, TD 7340.

San Patricio County. William Herbert Hunt Trust Estates' Mrs. Emma Herron 2, 2nd Addition to Taft Farm Lots, Section 8, flowed 9.6 million from Frio sand, Oligocene 8920-24 feet, open, completed 2-20-53, TD 9278.

TEXAS DISTRICT 4—NEW GAS PAYS

Hidalgo County, Tabasco field. Houston Oil Co. and American Republics Corp.'s Temple W. West, et al 7, Porcion 74, ungauged from L-1 sand, Oligocene 6984-94 feet, completed 2-9-53, TD 7516.

Nueces County, Bluntzer field. H. H. McFarland's Fannie Nason 3, Bluntzer Partition, Share 1-B, flowed 34.0 million from Frio "A" sand, Oligocene 5768-74 feet, open, 60.0-gravity, completed 2-14-53, TD 6535.

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TEXAS DISTRICT 4—GAS FIELD EXTENSIONS

Jim Wells County, Bentonville field. Morris Cannan's J. M. Dellinger & C. R. Clark 1, Los Presnos de Abajo Grant, Share 3, Parcel A-1, ⅔-mile southwest extension, ungauged from Frio sand, Oligocene 4202-08 feet, completed 2-9-53, TD 6029.

Kenedy County. Sun's State Tract 234-1, State Tract 234, Laguna Madre Bay, Old Well Worked Over, ⅔-mile northwest extension, ungauged from Marginulina sand, Oligocene 7234-75 feet, TD 8967.

TEXAS DISTRICT 6—NEW OIL FIELD

Cherokee County, "Fain" field. C. M. Ashby's C. H. Fain et al 1, S. S. Henry Survey, flowed 79 barrels from Woodbine sand, Upper Cretaceous 5123-24 feet, 10/64-inch, 32-gravity, completed 2-19-53, TD 5165.

TEXAS DISTRICT 7-C—NEW OIL FIELDS

Crockett County. Houston Oil Company et al's Mrs. Margaret A. Shannon Estate 1, Richard Pillows Survey, pumped 82 barrels from Pennsylvanian lime, Pennsylvanian 6608-18 and 6624-48 feet, 35.4-gravity, completed 2-27-53, TD 8190.

Reagan County. The Texas Co.'s State of Texas "AC" 1, Section 9, Block 11, University Lands Survey, flowed 288 barrels from Ellenburger lime, Ordovician 9410-9500 feet, 18/64-inch, 51.7-gravity, completed 2-5-53, TD 9742.

Schleicher County. Sinclair Oil & Gas Co.'s University-Schleicher "101" 1, Section 22, Block 54, University Lands Survey, flowed 342 barrels from Ellenburger dolomite, Ordovician 7910-8045 feet, open, 40.5-gravity, completed 2-6-53, TD 8045.

Upton County. Brown & Thorp Drilling Co. & John Parker's J. W. Robbins 1, Section 6, Block B, GC&SF Survey, pumped 24 barrels oil and 5 barrels water from San Andres lime, Permian 2180-2258 feet, 26.3-gravity, completed 2-13-53, TD 2261.

Upton County. Cities Service Oil Co.'s Noelke "B" 1, Section 4, Block A, MK&T RR Survey, pumped 12 barrels oil and 22 barrels water from San Andres lime, Permian 5638-51 feet, 32.8-gravity, completed 2-8-53, TD 6882.

Unnamed field. Gulf Oil Corp.'s McElroy Ranch Company-State 1, Section 182, Block E, CCSD&RGNG Survey, flowed 403 barrels from Devonian lime, Devonian 10,490-530 and 10,560-600 feet, ¼-inch, 47.1-gravity, completed 1-26,53, TD 12,762.

Unnamed field. J. D. Hancock's E. H. Sherk Estate 1, Section 7, Block 3, MK&T Survey, pumped 61 barrels from 2770-2805 feet, 28-gravity, completed 1-23-53, TD 2805.

TEXAS DISTRICT 7-C NEW OIL PAYS

Coke County, Bronte field. Humble's R. F. Butner 3, Section 397, Block 1-A, H&TC Survey, flowed 382 barrels from Cambrian 5541-53 feet, 16/64-inch, 32-gravity, completed 2-23-53, TD 5606.

Runnels County, Poe (Reef) field. Humble's W. J. Poe 2, J. L. Lynch Survey 442, pumped 47 barrels from King sand, Pennsylvanian 2868-74 feet, 44.1-gravity, completed 2-1-53, TD 3052.

TEXAS DISTRICT 7-C OIL FIELD EXTENSION

Coke County, Bronte, North field. Lion Oil Co.'s Edward 1, Section 365, Block 1-A, H&TC Survey, 1-mile extension, flowed 286 barrels from Ellenburger lime, Ordovician 5760-65 feet, 10/64-inch, 44.2-gravity, completed 2-8-53, TD 5940.

TEXAS DISTRICT 7-C NEW DISTILLATE FIELD

Crockett County. Cities Service et al's Hobbs "B" 1, Section 7, GC&SF Survey, flowed 945 barrels distillate and 12.5 million from Cisco sand, Pennsylvanian 5912-30 feet, open, 46.1-gravity, completed 1-11-53, TD 5984.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. Humble's State University "Q" 1, Section 15, Block 8, University Lands Survey, flowed 418 barrels from Devonian lime, Devonian 12,509-531 feet, ¼-inch, 44-gravity, completed 2-16-53, TD 12,533.

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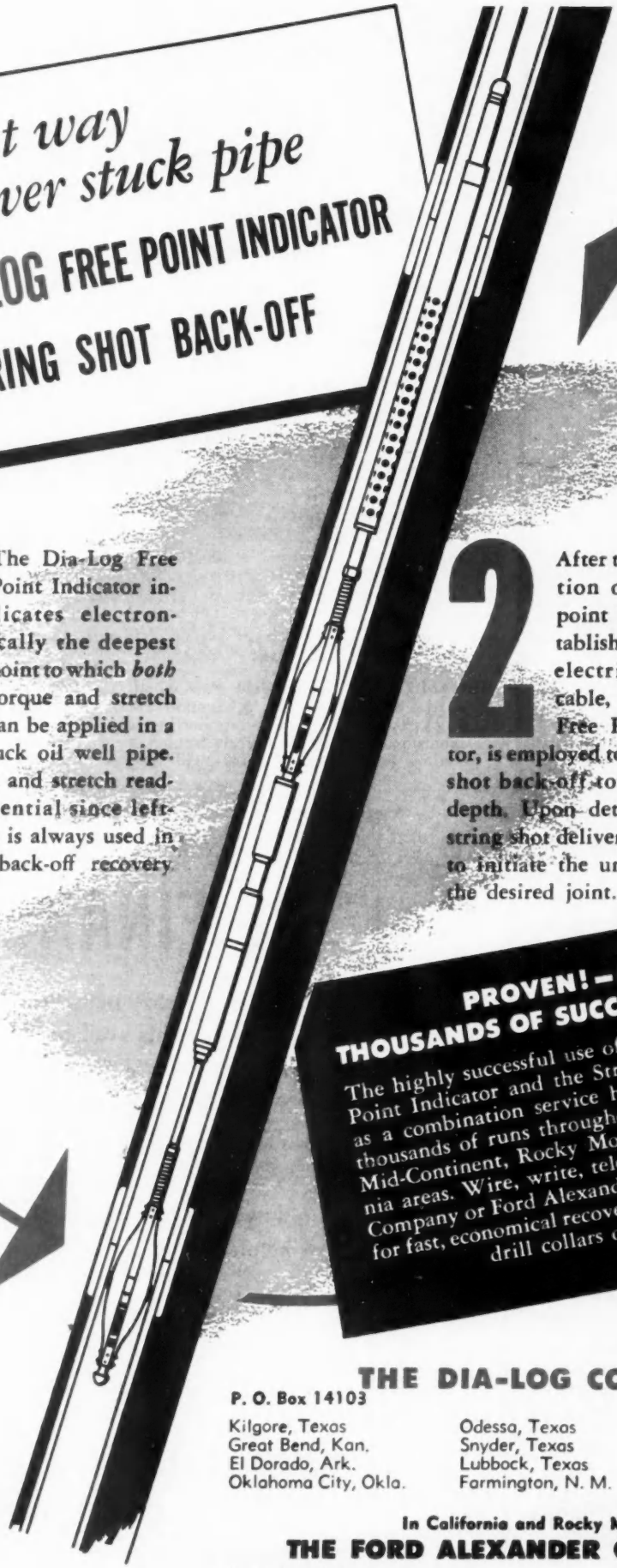

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Dawson County, "Arvanna" field. Seaboard Oil Co. of Delaware's R. M. King 1, Section 2, Block 35, T-6-N, T&P Survey, pumped 22 barrels from San Andres lime, Permian 3875-4340 feet, 2⅞-inch, 33.7-gravity, completed 2-14-53, TD 8960.

Dawson County. Ponder Oils, Incorporated's M. C. Lindsey 1, Section 109, Block M, EL&RR Survey, pumped 115 barrels from Canyon Reef lime, Pennsylvanian 8566-71 feet, 42-gravity, completed 2-14-53, TD 8589.

Hockley County. Stanolind Oil & Gas Co.'s B. E. Thompson 1, Section 27, League 21, McCullouch CSL Survey, flowed 298 barrels from Canyon Reef lime, Pennsylvanian 9875-9908 feet, ¼-inch, 42-gravity, completed 2-14-53, TD 9908.

Loving County. Jay H. Floyd's W. D. Johnson 1, Section 2, Block 57, T1, T&P Survey, flowed 58 barrels from Delaware sand, Permian 3106-07 feet, 20/64-inch, 42-gravity, completed 2-5-53, TD 3107.

TEXAS DISTRICT 8—OIL FIELD EXTENSIONS

Gaines County, Westlund field. Carl J. Westlund et al's Eugene Sherrod 1, Section 19, Block A-23, PSL Survey, 1-mile south extension, flowed 214 barrels from Upper Clearfork lime, Permian 6370-6410 feet, 1-inch, 32-gravity, completed 1-30-53, TD 6502.

Howard County, Snyder field. Fair-Woodward's Susie B. Snyder 3, Section 20, Block 30, T&P Survey, 1-mile northwest extension, pumped 90 barrels from San Andres lime, Permian 2633-2950 feet, 29.9-gravity, completed 2-2-53, TD 2950.

Martin County, Block 7-Devonian field. Jake L. Hamon's University "B" 1, Section 12, Block 7, University Lands Survey, ½-mile north extension, flowed 483 barrels from Devonian lime, Devonian 12,222-244 feet, ¼-inch, 44-gravity, completed 2-2-53, TD 12,257.

Yoakum County, Ownby field. Marlowe Oil Co.'s R. L. Moore, Jr. 2, Section 486, Block D, J. H. Gibson Survey, 1½-mile west extension, pumped 175 barrels oil and 31 barrels water from San Andres lime, Permian 5307-5468 feet, 33.1-gravity, completed 2-14-53, TD 5468.

TEXAS DISTRICT 8—NEW GAS FIELD

Gaines County. Texas Crude Co.'s Forest Dunbar 1-4, Section 4, Block A-28, PSL Survey, gauged 4.0 million from San Andres lime, Permian 4335-45 feet, ½-inch, completed 12-29-52, TD 4375.

TEXAS DISTRICT 10—OIL FIELD EXTENSION

Roberts County, Quinduno field. Gulf Oil Corp.'s John Haggard 4, Section 199, Block M-2, BS&F Survey, 1⅛-mile southeast extension, pumped 22 barrels from Albany dolomite, Permian 4119-65 feet, 49.3-gravity, completed 2-18-53, TD 4165.

UTAH—NEW OIL FIELD

Duchesne County, Flat Mesa field. Carter Oil Co.'s Joseph Smith 1, C SE SE 16-3s-5w, flowed 273 barrels from Basal Green River lime, Eocene 8820-60 feet, ¼-inch, 41.8-gravity, completed 12-4-52, TD 9103.

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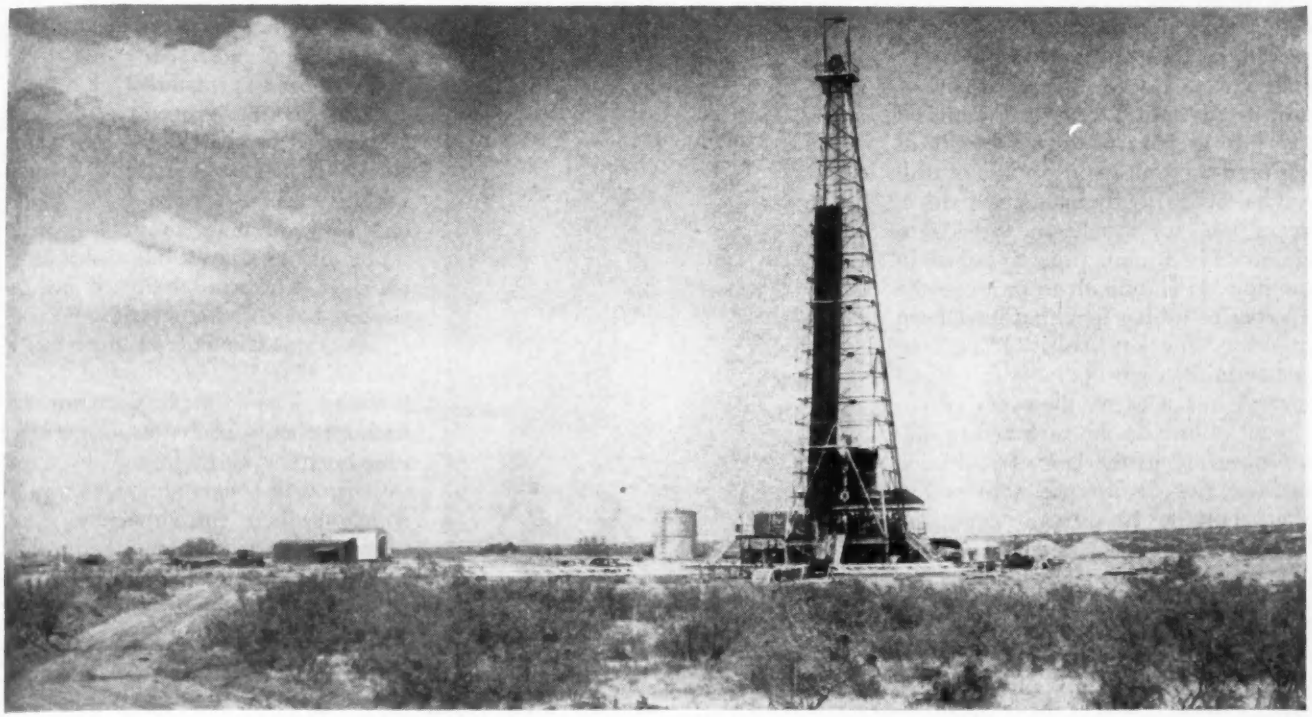


A typical West Texas scene where drilling is slow and expensive but operators are progressive. They are ever on the alert for new ways of reducing drilling costs and increasing drilling rates.

Current Drilling Practices In West Texas

Here's a review of techniques now in use and those which show promise in the Permian Basin.

By DAVID JOHNSTON, Humble Oil & Refining Company, McCamey, Texas
and W. R. JOHNSON, Humble Oil & Refining Company, Midland, Texas

THE PERMIAN BASIN of West Texas and Southeastern New Mexico has been one of the most active drilling areas in the U. S. for several years. On January 1, 1947 there were 2950 rotary rigs in use in the U. S., about 350 of which were actively operating in the Permian Basin. Six years later, at the end of 1952, the number of active rigs in the U. S. had decreased to 2628. However, the active rigs in the Permian Basin had increased almost 43 percent to 496. This concentration of drilling activity is to be expected in an area which produces about the same amount of oil daily as is produced in the states of Oklahoma, Louisiana, Mississippi and Arkansas.

Because drilling in the Permian Basin is slow and expensive and because so many rigs are operating in the area, there has been much interest in advances in drilling practices which tend to increase drilling rates and decrease rig operating costs. Interchange of ideas and information between operators is widespread through such mediums as an active API Committee on Drilling Practice. Thus, drilling techniques which prove economically sound spread rapidly throughout the area. This article will review practices now in general use in the area, and will discuss techniques and equipment which are not in area-wide use but which appear to offer promise in increasing drilling rates in the Permian Basin.

Part 1

WEIGHT ON BIT. In 1947 some of the early results of high weight-drilling were discussed at the spring meeting of the Southwestern District, API Division of Production.[1] It was pointed out at that time that maximum bit weights seldom exceed 5000 pounds per inch of bit diameter. This weight limit is still generally observed, with the possible exception of larger-sized bits, because experience has been that higher weights lead to premature bit failure; and also because there has apparently been no economical increase in penetration rate with higher bit weights.

It was noted at the same time that the use of high bit weights had brought about several problems. Among these were:

- Use and care of long drill-collar strings.
- Fishing for drill collars and cones.
- An increased tendency toward hole deviation with high bit weights.

The first two problems, use of long collar strings and fishing for drill collars, turned out to be closely re-

lated. Several interrelated ideas and procedures have developed which have materially reduced the incidence of drill-collar failure, and thus reduced the fishing hazard. Most important has been the routine inspection of drill collars, primarily by magnetic-particle inspection, for cracks in threads to eliminate bad joints prior to failure in the hole. It is difficult to estimate the number of fishing jobs that have been prevented by drill-collar inspection, but certainly each operator can recall several instances of discovery of incipient failure on the rack before failure occurred in the hole. In addition to inspection, in the past four or five years there has been more widespread interest in the development and use of properly balanced drill-collar box and pin sizes and in the stress relieving of drill-collar connections. It is probable that this latter design feature has been of more significance in increasing drill-collar connection life than have changes in thread design or work hardening of thread roots, both of which have received much comment in recent years. In any event, all of these procedures have tended to reduce the chances of a drill-collar fishing job.

Should a drill-collar fishing job occur, the development of very satisfactory "free point" indicators and the use of the string-shot technique in connection with the indicators has made fishing for long drill-collar strings much less hazardous.

Although no figures have been assembled on loss of bit cones, it is believed that slower rotary speeds, on the order of 60 revolutions per minute or less, have reduced loss of bit cones. Development of special cone baskets, the use of heavy mills to break up cones, and the development of magnetic fishing tools have all tended to reduce the fishing hazard.

Hole deviation is still very much of a problem and is discussed in more detail later herein.

Developments in Bits. During the past two to three years two types of rock bits have become important in West Texas, viz., the jet rock bit using high nozzle fluid velocities, and the "chert bit" with sintered tungsten carbide inserts. Although neither bit is suitable for use on all rigs in all situations, both have been used with sufficient success to merit discussion.

JET ROCK BITS. Initial experimentation with the jet bit principle in West Texas began as early as 1938. Water courses were added to bits and/or shrouds were installed between the cones with the idea of directing the fluid to the bottom of the hole. These early experiments and some as late as 1947 indicated no noticeable improvement in bit performance and, consequently, experimentation ceased. The success of the jet drag bit and, shortly afterward, the jet rock bit in the softer formation areas led several West Texas drillers to active testing of the jet rock bit approximately 2½ years ago. Results were promising enough that during the past 20 months Humble Oil & Refining Company rigs in West Texas have been using all jet rock bits within the limitations of the supply of integral jet bits and jet rock bit subs. The availability of integral jet bits is increasing steadily.

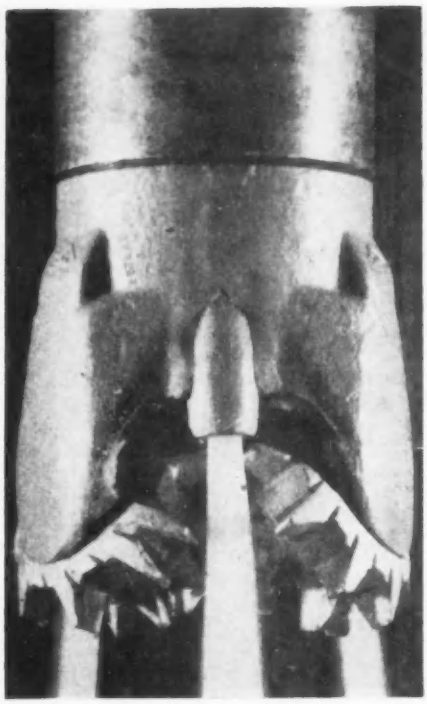


FIGURE 1

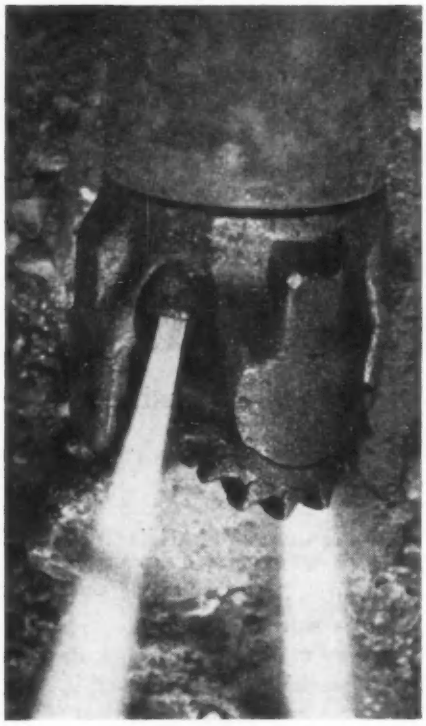


FIGURE 2

The evaluation of jet rock bits in West Texas has been more or less puzzling. The Humble Company has had excellent results using jet rock bits, but they also adopted the use of oversize drill collars and slower rotary speeds at about the same time, either of which may have materially aided bit performance. In addition, their rigs are equipped with pumps capable of putting in excess of 700 hydraulic horsepower into the hole. Nevertheless, there is no question in the minds of the people operating these rigs that the jet rock bit has improved drilling rate and reduced the number of bits.

Tables 1, 2, and 3 compare the use of jet and conventional rock bits in the Yarbrough and Allen field. In the 12¼-inch and 11-inch surface

TABLE 1
Jet vs. Conventional Rock Bit Performance
Yarbrough & Allen Field—12½-inch Surface Hole

WELL	Y&A 31	Y&A 32	Other Operators	
Depth	185-3,550	180-3,547	320-3,533	305-3,539
Footage	3,345	3,367	3,213	3,234
Bits	7 Jet	6 Jet	6 Jet 4 Conv.	13 Conv.
Rotating Hours	99¼	91	141	180¾
Feet per Hour	33.7	37	22.8	17.9
Feet per Bit	478	561	321	249

TABLE 2
Jet vs. Conventional Rock Bit Performance
Yarbrough & Allen Field—11-inch Surface Hole

WELL	Y&A 33	Other Operators		
Depth	173-3,545	305-3,425	306-3,400	280-3,563
Footage	3,372	3,120	3,094	3,283
Bits	6 Jets	7 Jets 3 Conv.	4 Jets 5 Conv.	14 Conv.
Rotating Hours	91¾	114½	118¾	182½
Feet per Hour	36.8	27.2	26.1	18.0
Feet per Bit	562	312	344	235

TABLE 3
Jet vs. Conventional Rock Bit Performance
Yarbrough & Allen Field—Lime Section, 8¾-inch Hole

WELL	Y&A 32	Y&A 25	Other Operators	
Depth	3,547-7,585	3,555-7,457	3,535-7,517	3,539-7,436
Footage	4,038	3,902	3,982	3,897
Bits	17 Jets 1 Conv.	15 Jets	24 Conv. 1 Jet	31 Conv.
Rotating Hours	271½	264½	263	254½
Feet per Hour	14.9	14.8	15.1	15.3
Feet per Bit	224	260	159	126

holes, the use of jet rock bits has increased the rate of penetration as much as 100 percent and reduced the number of bits required by 50 percent. This increase in bit performance is largely attributed to the higher bit weights that are possible when using jet bits. In the 8¾-inch hole through the Permian lime section, the two jet-bit-drilled holes shown in Table 3 had a slightly slower rate of penetration, but the number of bits required was reduced by as much as 50 percent. The over-all rig time required was considerably less on the jet-bit-drilled holes, and the reduction in bits alone more than paid for the 15 to 20 percent additional cost of the jet bits. Improvement in bit performance with the jet rock bit in the Yarbrough and Allen field has been consistently good in all hole sizes.

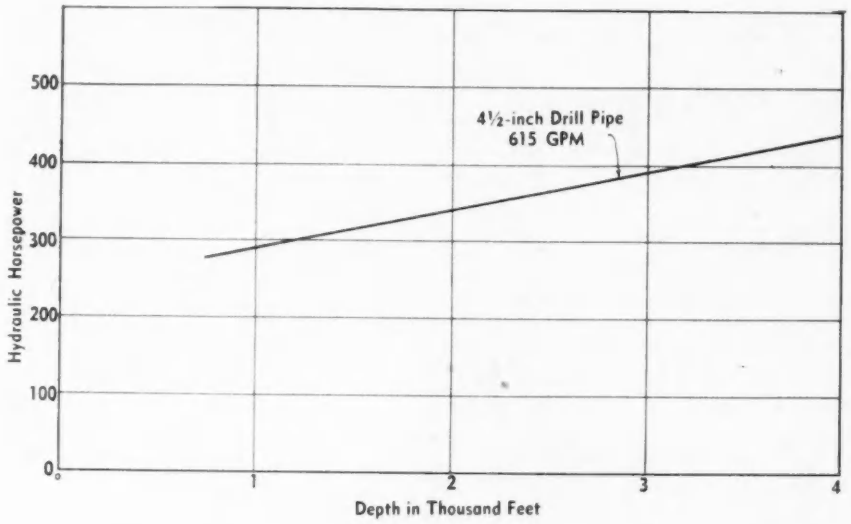


FIGURE 3
Hydraulic horsepower requirements for effective use of jet rock bits in West Texas. Eleven-inch hole, 300° feet, 7¾-inch by 2¾-inch drill collar, 9.5 pounds per gallon mud, nozzle velocity 225 feet per second, annular velocity 150 feet per minute.

Other operators have met with varying success with the jet rock bit. In general, those having adequate hydraulic horsepower available for use at the bit are using jet rock bits in the softer formations and are reducing over-all drilling time. Many others have tried the bits and have not shown enough improvement to convince them that the bits justified their use. There are several possible reasons why the average West Texas driller has not readily accepted the jet rock bit. In the first place, the average West Texas rig has 250 to 300 hydraulic horsepower available for fluid circulation. In a 12¼-inch hole at 3000 feet with 4½-inch drill pipe and 450 feet of 2¾-inch bore drill collars, approximately 1150 hydraulic horsepower is needed to maintain an annular velocity of 175 feet per minute and a jet nozzle velocity of 250 feet per second. There are probably no rigs in West Texas capable of delivering 1150 pump horsepower. Good jet bit results may be obtained by reducing annular and nozzle velocity, but not to the range where 250 hydraulic horsepower will permit effective jet bit operations in a 12¼-inch hole.

On the other hand, 250 hydraulic horsepower would be adequate in 6¾-inch, 7⅞-inch, and 8¾-inch holes to depths of 7500 feet or more, provided 4-inch OD or 4½-inch OD drill pipe is used with drill collars having a bore of 2¼-inch or larger, preferably larger.

Many West Texas operators feel that only rigs with extremely large pumps can properly use jet bits. This is not correct for the average West Texas hole program. Figures 3 and 4 illustrate the hydraulic horsepower requirements for an 11-inch-7⅞-inch hole program, which is a common program in the area. An annular velocity of 150 feet per minute and a nozzle velocity of 225 feet per second are assumed, and it is believed are adequate for good jet bit results. Referring to Figure 3, which is for an 11-inch hole using 4½-inch extra-hole drill pipe and 300 feet of 7¾-inch OD by 2¾-inch ID drill collars, it is noted that approximately 290 hydraulic horsepower is needed at 1000 feet and some 50 additional hydraulic horsepower per additional 1000 feet of hole. A typical West Texas program calls for 1800 feet of 11-inch hole, which would require a maximum of 350 hydraulic horsepower. Many West Texas rigs have one pump, or two pumps capable of parallel operation, which will furnish this amount of hydraulic horsepower and consequently could use jet bits.

Referring to Figure 4, which is for a 7⅞-inch hole using 450 feet of 6-inch OD by 2¼-inch ID drill collars, it is noted that the hydraulic horsepower requirements are shown for three sizes of drill pipe. The total depth of an average West Texas well is around 8000 feet. Only 140 hydraulic horsepower is needed at that depth with 4½-inch extra-hole drill pipe and 205 hydraulic horsepower with 4-inch full-hole drill pipe, both of which are

■ CONTINUED ON PAGE 146

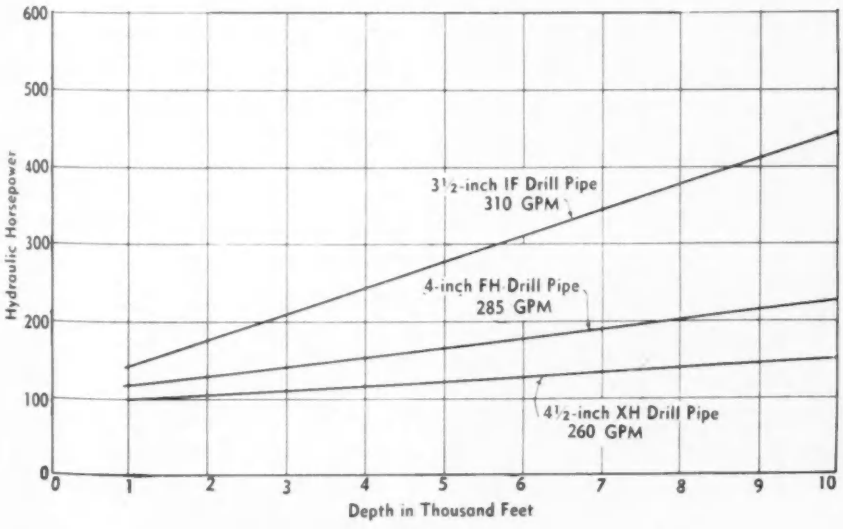
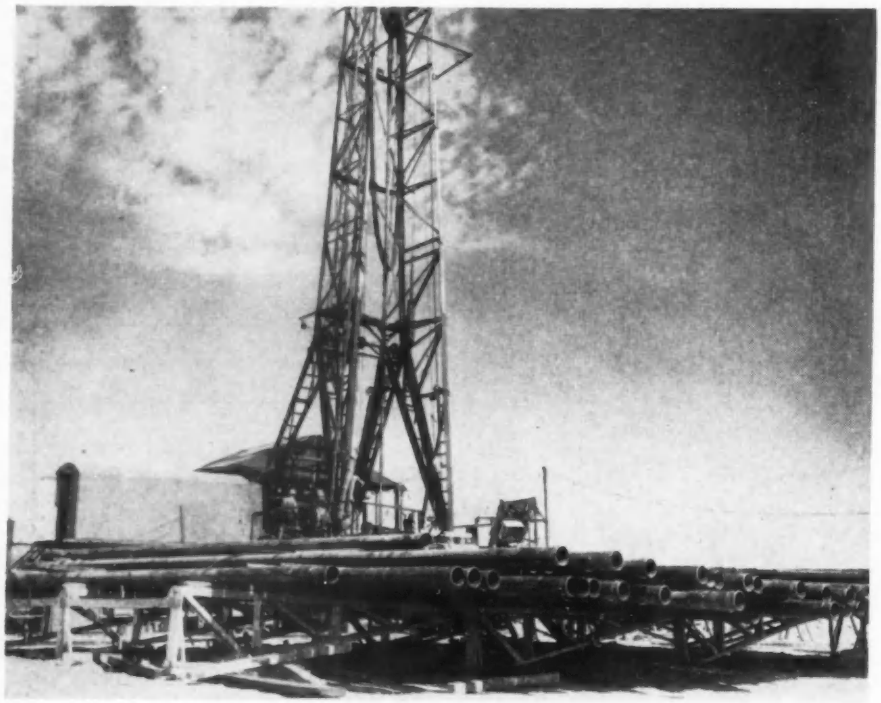


FIGURE 4
Hydraulic horsepower requirements for effective use of jet rock bits in West Texas. Hole 7⅞ inches, 450 feet, 6-inch by 2¼-inch drill collar, 9.5 pounds per gallon mud, nozzle velocity 225 feet per second, annular velocity 150 feet per minute.



Casing must be identified positively prior to running combination strings. Proper marking, tallying and unloading procedures will expedite its handling, offering economical solution to troublesome problem.

How to Identify Casing In Mixed Strings

Double checking prevents discrepancies and insures pipe will be run as intended.

RUNNING combination casing strings in a well is accepted field practice and has proved satisfactory and economical. Mixed strings consist of pipe of similar diameter but varying weight and specification.

It is not uncommon for wells to run combination strings of five or six different weights. Consider a West Texas well which set 16,071 feet of 7-inch combination string. On bottom, 38-pound N-80; above that section, in order, were 35-pound, 32-pound and 29-pound N-80. At the bottom of the string was a section of 32-pound internal upset. Many similar combination casing strings can be run.

Although most companies vary in the method of combining mixed casing strings, selections are based primarily on the factor of safety. In other words, the right string has to be set in the right place in order to achieve the minimum factor of safety specified by the drilling department. This means that field personnel must be careful in identifying casing so that the combination string may be made up in accordance with the accepted policy of the drilling department.

Mixed strings consist of pipe of similar diameter but varying weight and specification. Proper identification is difficult in long strings without a double-checking procedure.

Three steps are necessary to insure that the right casing will be run in the correct place in the string:

- The casing must be identified positively by someone who is familiar with tubular goods.
- It must be plainly marked to eliminate danger of confusion.
- For convenience, it must be unloaded at the well in such a way that the crew can pick up the bottom section of the string first, the next section next, and so on.

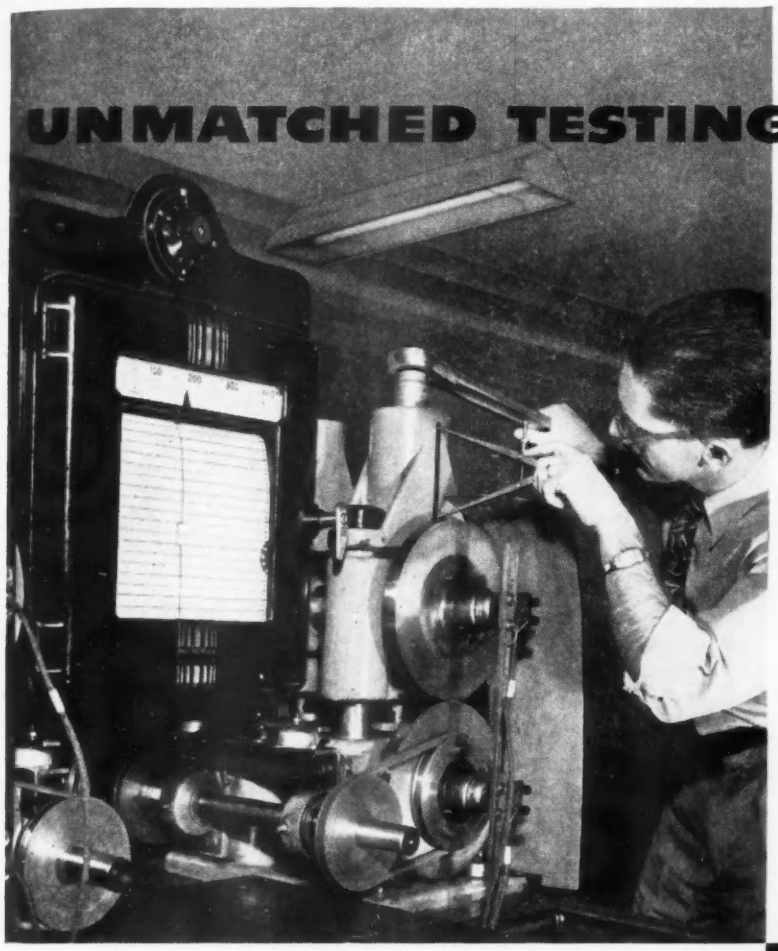
Operators have different methods of identifying the string. One operator paints the couplings different colors as an identifying mark. Some operators use a numbering system, marking lengths for the bottom of the string with "1", the next section "2", the next "3", and so on.

Here is a detailed description of Standard Oil Company of California's procedure and a copy of the tally sheet used for double-checking casing strings:

All casing strings are designed by the company's Petroleum Engineering Division and detailed as part of the well program. This detail includes the footage of each size, weight and grade from top to bottom of the well.

When the casing is ordered out to the well by the drilling foreman, it is measured out by the Purchase and Stores Department tubular control specialist according to the detail given in the previously mentioned well program. Each length is loaded on trucks so that when unloaded at the well, the top length of the casing string will be placed on the well rack first, with every successive length following in order from top to bottom of the well. The last length on the rack will of course be the shoe length and will be the first run into the hole.

While the casing is being loaded out by the Purchase and Stores Department, each length is numbered and marked in successive order, starting from the top length. Each crossover



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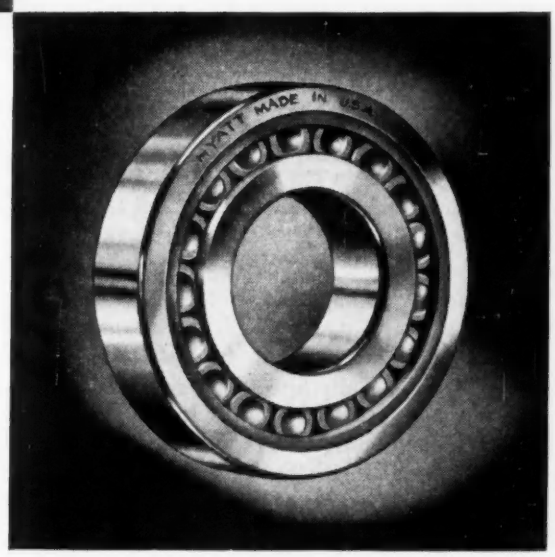

HYATT ROLLER BEARINGS

CASING TALLY SHEET

PAGE ____ OF ____ PAGES

FIELD ____ PROPERTY ____ WELL No. ____

SIZE ____ O.D. WT. ____ #/FT. THREADS ____ GRADE ____ RANGE ____

MAKE ____ TYPE ____ MIN. I.D. ____ INTERNAL UPSET / NOT UPSET ____

COUPLINGS: TYPE ____ MAX. O.D ____

DELIVERED: JTS ____ FT. OVERALL: USED ____ JTS.: LEFT ON RACK ____ JOINTS

TYPE OF SHOE ____ TYPE FLOAT COLLAR ____

STARTED CASING A.M. / P.M. ____ DATE ____ CASING ON BOTTOM A.M. / P.M. ____ DATE ____

JOINT	MEASUREMENTS: RACK-LENGTH FEET	RACK-LENGTH TENTHS	MADE UP-LENGTH FEET	MADE UP-LENGTH TENTHS	REMARKS: CHECK WHERE MEAS. DIFFER	JOINT	RACK-LENGTH FEET	RACK-LENGTH TENTHS	MADE UP-LENGTH FEET	MADE UP-LENGTH TENTHS	REMARKS: CHECK WHERE MEAS. DIFFER
1						1					
2						2					
3						3					
4						4					
5						5					
6						6					
7						7					
8						8					
9						9					
0						0					
TOTAL A						TOTAL C					
1						1					
2						2					
3						3					
4						4					
5						5					
6						6					
7						7					
8						8					
9						9					
0						0					
TOTAL B						TOTAL D					

TOTALS	TOTAL THIS TYPE CASING: RACK	MADE UP	REMARKS	TOTAL	TOTAL ALL CASING: RACK	MADE UP	ADDED BY	CHECKED BY
TOTAL A				BRT. FWD.				
TOTAL B				PAGE TOTAL				
TOTAL C				GR. TOTAL				
TOTAL D				REMARKS				
PAGE TOTAL								
BRT. FWD.								
TOTAL								

NOTE: START NEW SHEET FOR EACH DIFFERENT GRADE OR WEIGHT OF CASING

FIGURE 1

is further identified and clearly marked.

Before the casing is run into the well, a "Casing Tally Sheet" (Figure 1) is prepared with all lengths to be run shown according to number and with a separate sheet for each grade or weight. Each length of the top row on the rack to be run is measured and recorded opposite its number on the tally sheet. As this group is run into the well the general practice is to measure each length again after making it up and while the string is hanging free in the hole. This second set of measurements is entered in the parallel column of the tally sheets and any discrepancy greater than 1/10 foot immediately noted and rechecked.

Each weight and grade must be identified by the crew in setting up its tally sheets. Comparison with the designed string, as supplied by the Petroleum Engineering Division insures that the casing is being run in as originally intended.

The total number of lengths delivered to the well at the start of the job should check the actual number of lengths on the hook when the casing is landed, plus the number left on the rack.

Careful design of casing programs may save large sums of money. Economics of casing design depends on the stresses imposed and conditions presented—which usually means the number of strings required.

If important savings may be realized by the use of tapered casing, then handling should be expedited by carefully identifying, marking and unloading in the order to be run.

ACKNOWLEDGMENT

Published through courtesy Petroleum Extension Service, The University of Texas, Austin.

West Texas Drilling Practices

■ CONTINUED FROM PAGE 143

in the power range of practically all rigs in the area. With 3½-inch Internal Flush drill pipe, the hydraulic horsepower needed jumps to 375 which is out of the range of most area rigs primarily because a pump pressure of around 2000 pounds per square inch would be needed.

The improvement with jet rock bits in the average small hole is difficult to recognize, primarily because the improvement comes in increased bit life. There are numerous cases where jet rock bits have been run in the Lower Permian and some deeper sections under maximum weights for periods as long as 20 to 25 hours. In these sections two years ago average bit life was 6 to 12 hours. It is difficult for many drillers to realize that bit performance can be improved by leaving a bit in the hole, especially when they have become accustomed to short bit life.

Table 4, which uses the same data from the Yarbrough and Allen field as did Table 3, illustrates the increase in bit life possible with jet bits. In this case the minimum increase is 50 percent and the maximum exceeds 100 percent. This is probably one reason why some drillers have not been satisfied with jet rock bits even though the horsepower was available. A rotary torque indicator is very helpful in determining when to pull a jet rock bit in all but the very abrasive formations. It has also been noticed that slow rotary speeds are effective with jet bits, and may be a decided factor in the bit life increase.

TABLE 4

Jet vs. Conventional Rock Bit Performance Yarbrough & Allen Field—Lime Section, Hours per Bit—8¾-inch Hole

WELL	Y&A 32	Y&A 25	Other Operators	
Depth	3,547-7,585	3,555-7,457	3,535-7,517	3,539-7,436
Footage	4,038	3,902	3,982	3,897
Bits	17 Jet 1 Conv.	15 Jet	24 Conv. 1 Jet	31 Conv.
Rotating Hours	271½	264½	263	254½
Rotating Hours per Bit	15.1	17.6	10.5	8.2

(First of Two Parts)

REFERENCE

1. Johnston, David: Hard Rock Drilling in the Permian Basin Drilling and Production Practice, 50 (1947).

ACKNOWLEDGMENT

This paper was presented at the Spring Meeting of Southwestern District Division of Production, API, in Fort Worth, Texas, March 4-6.

Finishes what it starts

From site preparation to final clean-up, no single piece of equipment is as useful as a Caterpillar D6 Tractor equipped with a No. 6A Bulldozer.

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Mr. Ostrander is pipe-laying foreman for Otis Eastern Service, Inc., Wellsville, N. Y. The company's handy, rugged D6 is shown filling around valve boxes after a drill rig has been moved at Lock Haven, Pa.

The D6, equipped with a bulldozer and a Hyster 6N Winch, is used by Otis Service to lay pipe, clear out for locations, and for cleaning up after drilling and abandoning wells.

The talented Cat angling-type Bulldozer is master of any job it tackles. Deftly taking large loads, it holds them on the blade and puts them where needed. The blade, sturdily built of five box sections, can be angled into three positions by one man.

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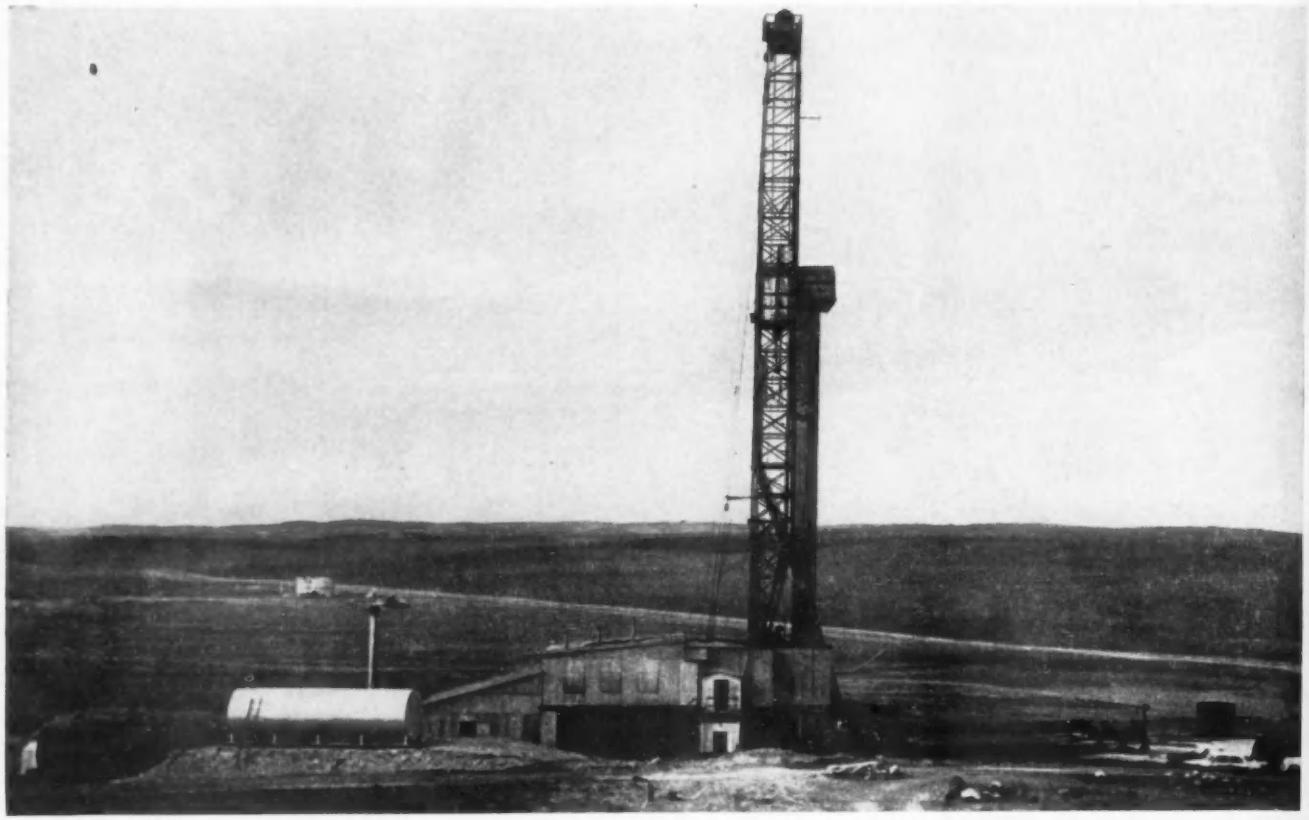


This is Shell Oil Company's 21-33-B discovery well in the Southwest Richey area of McCone County, Mont. It is west of the Baker-Glendive anticline proper and south of the original Williston Basin discovery in Montana at Richey in northwestern Dawson County.

Drilling Problems In the Williston Basin

. . . . and how they're being solved by perseverance, ingenuity and experience.

By TOM DOUGHERTY
Petroleum Information, Denver, Colo.

PERSEVERANCE, INGENUITY and experience are solving the formidable and expensive problems of drilling in the Williston Basin.

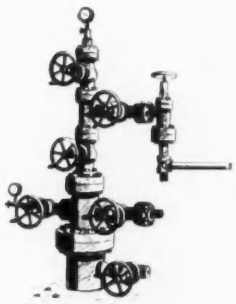
Complete winterizing has become routine for wells started during the winter months, or at any time when completion is not expected before the advent of severe weather. Rigs are steam heated and steam lines and water lines are laid in a common ditch to keep water available during the cold months. It has been necessary to burn mixed lignite and straw to thaw the ground before the pits could be dug in many cases.

The weather has also inspired man-made laws which throw up transportation barriers. Since the roads of the Dakotas and Montana are subject to a seasonal battle with frost in late winter and early spring, severe load restrictions are placed on truck movements, especially at the critical time of the "breakup." Operators who moved into the area shortly after the initial discoveries found themselves with irreducible loads which couldn't be moved except in defiance of regulations. It is impossible, for instance, to break down the weight of a drawworks beyond a given point. However, every possible cooperation was given by the states concerned and active rotary rigs in Montana passed the 50 mark during 1952, with more than 30 active in North Dakota at times during the year.

Movement of rigs and other equipment by rail and short-haul trucking at favorable times became the rule before the end of the first year's work in the basin. At the beginning of 1953 the transportation problem was anticipated by movement of equipment during the winter with the intention of stacking until the weather breaks.

While mud problems in the basin are regarded as extremely difficult, the mud program in the Beaver Lodge area of North Dakota is approaching the routine stage. From surface to Triassic (Spearfish) wells are drilled with water and when combined with the bentonitic shales encountered produce a native mud. Thick beds of salt and other evaporites are penetrated below the Spearfish, necessitating a conversion to a gyp-base mud, which is used to total depth. After conversion to gyp mud, natural contamination from formations saturate the system with salt. A salt conversion, so expensive in early drilling in this area, is thus avoided.

Additives in this program include starch to control water loss, and a



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BIW NON-LUBRICATED GATE VALVE

The BIW Valve has been proved dependable under the most difficult well conditions. The heavy duty thrust stem bearing makes opening and closing easy without the use of a cheater. A positive, tight shut-off is made every time because the BIW Valve is non-lubricated, requires little attention, and effects a tight closure with metal-to-metal seals.

The complete BIW Tree puts the undivided responsibility of one of the industry's oldest manufacturers squarely behind your well. In East Texas, the Gulf Coast, and the Permian Basin, BIW well head equipment has proved itself over the years under practically all well conditions. When you invest in well head equipment, invest for the life of the well with the complete BIW Tree. BIW Well Head Equipment is built from 1,000 to 10,000 pounds working pressure and combines the latest in engineering design with the best in the field practice.

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preservative for the starch. In many cases either crude or diesel oil is added to the system.

Surface to Spearfish mud weight is about 9 to 10 pounds per gallon with viscosity from 45 to 65 seconds, and water loss 10 to 15 cc. Weight is increased to as much as 11 pounds below this formation, with about the same viscosity and a 5-12 cc water loss. Little lost circulation is encountered in the Beaver Lodge area.

Somewhat different solutions are used in Montana. Native mud with some caustic-quebracho treatment is used to the Lower Jurassic. Used below this formation are special muds, including gyp-base with starch additive. Sloughing and caving are major problems in some areas.

Frequent watering back is necessary, with the addition of chemicals to retard water loss and maintain viscosity. Mud characteristics in this area approximate those in the Beaver Lodge area.

Montana Mud Costs. Mud costs in Montana exploratory drilling have been high due to loss to formations and the resultant high mixing time and high materials costs.

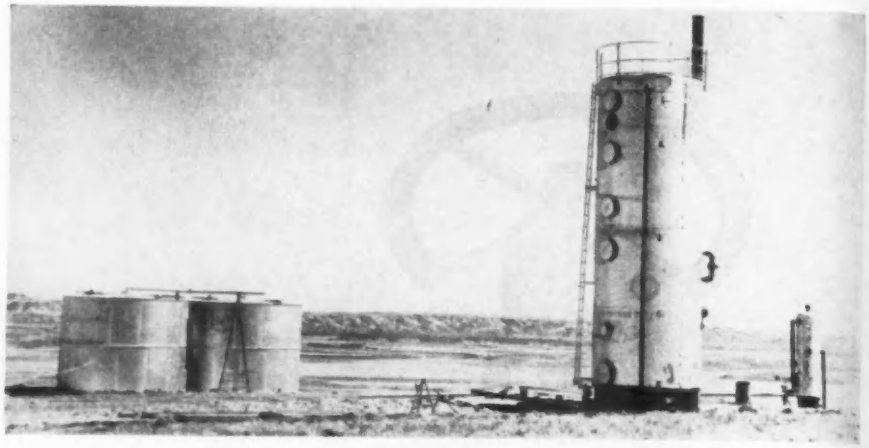
Drilling weights to the Dakota formation (Cretaceous) are generally in the range from 3 to 10 tons; pump pressures range from 400 to 950 pounds per square inch; and rotary speeds average from 90 to 130 revolutions per minute.

From the Dakota to the Madison (Mississippian) weights increase to 8 to 16 tons; pump pressures go up to from 750 to 1000 psi; and rotary speeds drop to about 70 rpm. Below the Madison drilling weights may be increased to as much as 20 tons.

As many as fifteen 6- to 6 7/8-inch drill collars may be used, with the number increasing in proportion to the weight carried on the bit.

Pump pressures in North Dakota drilling generally range higher than those in eastern Montana. The same is true of rotary speeds except below the Madison, where a lower range is maintained.

Operators in Montana have generally used 13 3/8-inch surface pipe, set after drilling 12¼-inch hole and reaming to 17½ inches. In North Dakota surface casing is generally 10 3/4-inch set to at least 600 feet, as required by regulation. Below surface in both areas of the basin 8 3/4- or 9-inch hole is drilled to permit setting of 5½- or 7-inch oil string.



Here's a typical tank and treater installation in the Williston Basin.

Long-tooth bits are used from the surface to the Dakota, with penetration per bit running about 700 feet or slightly more. Short-tooth, hard-formation bits are used below the Madison, with penetration ranging from 110 to 185 feet per bit from the Dakota to the Madison, and 45 to 65 feet per bit below the Madison.

Coring in both Montana and North Dakota wells is principally by diamond bit. A good average rate of penetration is about 3.1 feet per hour, and as much as 3250 feet has been cored in a single well. Coring in the Baker-Glendive area still approximates 500 feet per well, while in the development program at Beaver Lodge this operation has been reduced to a minimum.

Completion Time. The gradual solution of the basin's many drilling problems is resulting in shorter completion times. Amerada Petroleum Corporation spent 298 days from spudding to completion of the North Dakota discovery well. This included drilling to 11,955 feet, testing, coring, and other operations common to a wildcat of this nature. Another well spudded in 1951 required 251 days to completion in Mississippian formations at 8580 feet. By April, 1952, Amerada was completing wells to 8600 feet in 39 days. More recently a new record of 28 days was established.

This rig is on location for Shell's 34-26 in Glendive area of Dawson County. Well was completed for one of highest potentials in Rocky Mountain region. A production of 3820 barrels per day was gauged and a calculated potential from all apparently productive zones was fixed at 6700 barrels daily.

Penetration in both Montana and North Dakota is fairly rapid to the Dakota, which ranges from 3100 to 6500 feet. A typical Beaver Lodge well made 4525 feet, surface to Dakota, in six days. From the Dakota to the Madison penetration is appreciably slower, the same Beaver Lodge well having required 18.6 days from 4525 to 8230 feet.

Penetration is even further retarded below the Madison. In northwestern North Dakota, 980 to 1675 feet per day may be made with rock bits from the surface to the Dakota. From the Dakota to the Madison the rate falls to 185 to 275 feet per on-bottom day, while below the Madison the rate per day ranges downward from 65 feet. A slight increase in average penetration rate has been noted in formations below the Devonian.

This same over-all comparison holds true in eastern Montana. While actual figures may vary, the percentage relationship of drilling rates remains roughly the same as different levels are compared.

When air is used in drilling instead of mud, rock cuttings emerge from a flow pipe at the surface and fall into a pile. The method is basically the same as that using mud for circulation.

What About Compressed Air?

- **Its use as a circulating medium is relatively new and poses many problems.**
- **It has been effective in hard rock country.**
- **It may help solve problem of lost circulation.**
- **It has been successful in the tricky Spraberry sands.**

By LAWRENCE K. SHALLENBERGER
Tulsa, Okla.

COMPRESSED AIR as a medium for removing well cuttings from a rotary drilled borehole has been used successfully in a number of shallow and deep wells during the past few years. It may help solve the problem of lost circulation and it has proved effective in well completion work in the tricky Spraberry sand where conventional methods have not always been successful. Although the technique has many problems which only time and experience may solve, field experience has been so satisfactory that it is being carefully studied and evaluated by many oil companies and drilling contractors.

The first practical methods of removing drill cuttings by compressed air instead of water was reported in quarrying operations in 1949. Since then numerous such drills have been in continuous use in quarrying, open-pit mining, core drilling and similar work. Drillers observed that the rock-bit life was appreciably extended, penetration rates were greatly increased and drilling costs reduced. Reasons for these favorable results were sought.

The increased rate of penetration was ascribed to the fact that air does not set up eddying currents around the bit, as does water, and thus does not hinder the ejection of cuttings. A considerable regrinding of cuttings is avoided, leaving the bit more free to attack virgin rock.

Drillers in medium to hard limestone formations in Michigan reported increased penetration rates of from 55 to 66 percent. Longer bit life was attributed to prompt cleaning of the hole. It was assumed that if cuttings were removed from the proximity of the bit, the bit teeth would not be unnecessarily worn in the grinding of material already cut from the rock,

Old and new drilling methods vie with each other in this picture. The old cable tool rig in foreground is much slower than the larger rotary rig using compressed air. Both methods can be used, however, when cracks in underground formations cause high loss of drilling mud.

and there would be less fine particles present to come in contact with the bearings.

Results Studied. These interesting results were studied by oil well drilling engineers. They attracted the attention of Shell Oil Company, which had experienced lost circulation troubles in seismograph shot holes in the New Braunfels area and the Edwards Plateau region of West Texas. Shell also faced the problem of keeping drilling fluid from freezing in Canadian operations with temperatures in the subzero range.

In tackling the lost circulation problem in West Texas, Shell converted a conventional shot hole rig by connecting an air compressor directly to the stand pipe, thus supplying the rig with 315 cubic feet of air per minute at 125 pounds per square inch. Bits for various formations were carefully selected. In the area west of San Angelo, where formations are hard limestone, Shell rigs drilling with conventional methods were averaging 1½ holes per day and required 21 truckloads of water per 100 feet. In the same area, air rigs run by the same crews averaged 2½ to 3½ holes per day. A good deal more than 100 percent increase in the rate of penetration was realized, and the need for the expensive water hauls completely eliminated. These same Shell crews solved the minor problem encountered in the drilling of wells that made a small amount of water by washing the hole down with water and at the same time slowly pulling out the string while it was being rotated.

In its Canadian operations, Shell also reported favorable results where water used for drilling was subjected to temperatures as low as —40° F. Substituting air as the circulation medium naturally eliminated all trouble caused by freezing water.

The many and varied functions of drilling mud are well known and need not here be enumerated. Neither is it presumed that this medium will, in the near future, be replaced entirely by compressed air in the drilling industry. However, many problems encountered in drilling appear to have their resolution by the use of air and in ways that may some day prove more efficient and economical than water or mud as the medium.

For example, when cavernous formations have been contacted while drilling with air, the loss of air circulation will occur for only a few minutes, whereupon it will again return cuttings to the surface. The air, following the line of least resistance, deviates from its normal vertical course and enters the void in the formation. If the cavern is of appreciable size, the air will lose velocity and the cuttings are dropped. Because of this action, it requires but a short time interval until enough cuttings have been dropped to plug up or seal off the void entirely and restore circulation.

The Geotechnical Drilling Company, operating in West Texas, had two water rigs drilling two 150-foot shot holes. At 60 feet after drilling 10 hours they encountered caverns. One ton of mud, 5 loads of water, ½ ton of bran and 2 rock bits were lost. An air rig was set up between the two locations and drilled a 150-foot hole in 3½ hours with no trouble, and the same bit was used to drill another hole.

Carl B. King Drilling Company used air successfully in drilling a Spraberry pay section. At 7000 feet air was circulated to drill out the cement plug in the oil string and to penetrate the zone which produces primarily through fissures and crevices which can easily be partially or totally plugged off by the use of conventional drilling fluids. Air was delivered to the derrick floor at 500 psi after being compressed in two stages. The first stage, using ten portable compressors ranging up to 350 cubic feet per minute, compressed the air to about 120 psi and discharged it into a four-inch manifold where an external water spray cooled it from a compression temperature of about 150° F to 90° F. The secondary compression stage brought the air up to the final pressure at a temperature of about 180° F. This was done by three single-stage machines sending the air directly to the rig through a three-inch line.

The average circulation rate was 40,000 cubic feet per hour or 1 million cubic feet per day. The procedure was to drill with reverse circulation, the air flow moving down the annular space and returning through the drill pipe. Conventional circulation was tried initially on this operation but it was found that cuttings were pulverized to such an extent they were worth-

less for geological determination. Reverse circulation supplied cutting samples of sufficient size to permit adequate analysis.

While the method was successful, the installation did not represent the ultimate in design efficiency since it was assembled in a minimum of time and without the most efficient type of equipment.

Air has a tendency to transport the cuttings from the area of the bit immediately after they have been cut from the formation. This reduces bit wear and apparently accounts for the longer life that has been realized from bits in air service.

Water Not Needed. Another important advantage when using air, especially in seismograph shot hole drilling, is that water no longer is required for circulating purposes. This need, especially in arid areas, entails long and expensive hauling with its many disadvantages only too well known to the exploration company and the contractor.

Drilling with air poses one problem which has not yet been resolved judging from conflicting field reports. The problem concerns the effect of drilling with air through formations containing various amounts of moisture. Some observers contend that any moisture in the hole will have a detrimental effect on the success of the operation. Others declare that the presence of a great deal of water is not necessarily a handicap to the air rig; that difficulty is encountered only when there is just enough water present to make the sides of the hole sticky and enough left over to mix with the cuttings, causing them to stick to the drill stem.

Photos courtesy Shell Oil Company

Five of the nine compressors that supply air for Shell Oil Company's air drilling operations at South Mountain field, California, are shown here on one of the mountainside "island" drilling sites.

Shell Oil Company used an air rig to drill a seismograph shot hole to 500 feet in the Edwards Plateau region near Big Lake, Texas, using 2⅜-inch drill pipe and 4¾-inch tricone bit with a 1-inch watercourse. A 315 cfm compressor was the source of the air. At 375 feet the bit entered a cavernous zone and the cuttings, instead of coming to the surface, were blown into the crevices for about 15 minutes, after which they recirculated to the surface. (Lost circulation of drilling fluid in a zone of this nature would be difficult to recover). From 465-490 feet the bit entered a blue clay, after which it penetrated a sandstone formation that produced a large flow of water which rose to the surface. The water rising in the hole in conjunction with the air flushed the well clean. There was no trouble in removing the bit.

In some of the earlier experiments conducted in late 1950, Morrison & Peachee, drilling contractors, used an air-converted rig to drill 4½-inch holes to an average depth of 200 feet near Fort Stockton, Texas. Average drilling time was three hours a hole, or little more than one foot per minute. Their experience showed that the rate of penetration using air proved only equal to conventional drilling with circulation, and that air drilling was practical for holes that were dry all the way, or for wet holes that were not too deep. The method was found to be more or less impractical when the formations were wet enough to become pliable and sticky.

According to Walters Drilling Company, air can be used anywhere that cuttings can be blown from the hole. Factors governing this condition are:

- The diameter of the hole.
- The depth of the hole.
- The amount of air available.
- The diameter of the drill stem.
- The type of bit used.
- The formations to be cut.

Reserve Capacity. In shot hole drilling rigs the reserve capacity of the

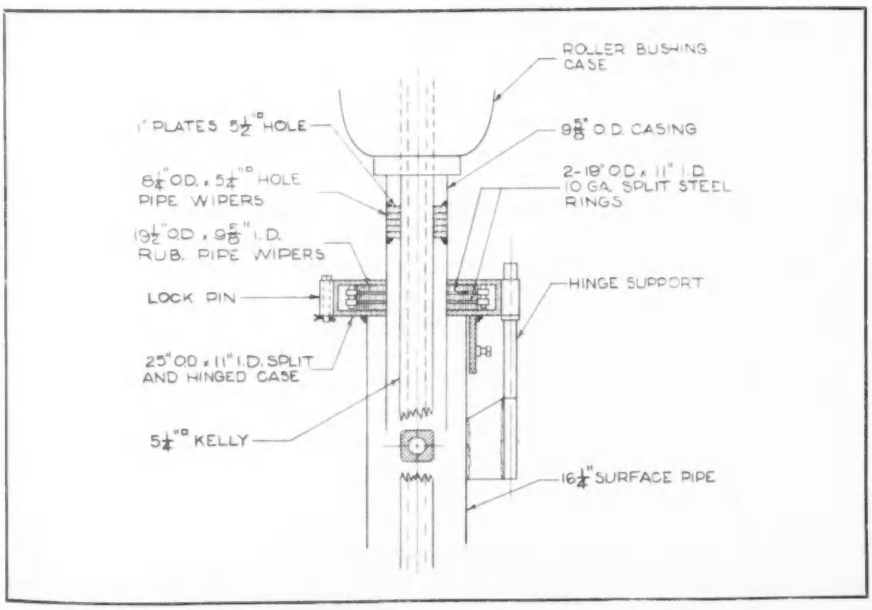

ROLLER BUSHING CASE
1" PLATES 5½" HOLE
9⅝" O.D. CASING
8¼" O.D. x 5¼" HOLE PIPE WIPERS
2-18" O.D. x 11" I.D. 10 GA. SPLIT STEEL RINGS
19½" O.D. x 9⅝" I.D. RUB. PIPE WIPERS
LOCK PIN
HINGE SUPPORT
25" O.D. x 11" I.D. SPLIT AND HINGED CASE
5¼" KELLY
16¼" SURFACE PIPE

FIGURE 1. Kelly packoff assembly.

compressor is important because as the depth increases, a larger volume of air without an increase in pressure tends to increase the uphole velocity of the air and thus cleans the wall of the hole. If a compressor is used with a cutoff of 50 psi, a larger volume of air will be required to clean out the hole than if a compressor is used with a cutoff at 125 psi. For example, if a 450-cfm compressor at 20 psi is used to clean a 6½-inch hole at a depth of 100 feet, the operation will be more efficient than if a 315-cfm compressor at 20 psi were used to do the same job. In several operations when black gumbo or sticky shale was struck, 450 cfm at 40 psi did not give a continuous clean 4¾-inch hole at 30 feet. However, occasional blasting with 50 psi was all that was necessary to clean out. In general, large volumes of air at low pressure seemed to give better results than air at high pressure and comparatively low volume.

Drill pipe that seems to give optimum service is the external flush-joint type weighing just as much as can be economically handled by the machine. The only limit to the diameter of the drill pipe is that it be just large enough to allow free passage for the largest cuttings. The optimum limits for the drilling of shot holes as reported by Walters Drilling Company are: drill pipe clearance from ½ inch to 1¼ inch; air pressure from 15 psi, and air volume from 315 cfm to 450 cfm. Using these values, the air drilling of 6¼-inch holes to 150 to 240 feet was accomplished in the same length of time that a spudder drilled a 6-inch hole to 50 feet.

In the Edwards Plateau region operation previously mentioned, a slightly different modification was installed in a standard medium weight shot hole rig. A three-way plug valve was installed in the discharge line of the rig so that a 90 degree turn of the handle would provide either air or water. The compressor hose had a quick couple on the end so that connection could be made easily and almost at once at the plug valve. When a depth of 350 feet was reached, drilling with air, a cavernous zone was encountered. The cuttings were blown into the crevices for a few minutes and then began returning to the surface. At depths of 400 and 500 feet water was encountered, but air pressure of 20-60 psi (maximum 100 psi) was sufficient to clean the hole.

Air Free Bit. Another interesting experiment which proved successful on the same location was the use of air to free the bit from the bottom of the hole. At 440 feet in an attempt to come out of the hole, the bit was stuck by falling cuttings. After hours of unsuccessful effort to free the bit it was decided to clean the hole with air. The anticipated results were dubious since 100 psi maximum was not sufficient to lift the hydrostatic head of mud and water at the 440-foot depth. The air line was connected but for 15 minutes air under maximum pressure had no effect in freeing the bit. The three-way plug valve was turned and water under high pressure was tried for a time with no effect. Air was again circulated for a few minutes, and then water to get an upward movement and compress the trapped air below. Then by quickly switching to air again, two separate columns of water blew out the hole to a height of 20 feet above the top of the mast, freeing the bit.

The question of trying to drill heaving and unconsolidated formations with air should be further investigated. In drilling this type of formation with mud there has been some indication that the washing of the mud was the factor that caused the caving, and there have been other indications that perhaps water transfer or osmotic pressure was the reason which resulted in this condition. However, there appears to be reason to believe that this situation might be alleviated by the use of air.

In all of the operations described in this article, the use of air has presented the problem of ever-increasing quantities of dust piling up at the surface, blowing in the driller's face and making the crew uncomfortable and thus reducing efficiency.

Shell Oil Company in developing a 940-acre lease in the South Mountain oil field, California, resorted to air drilling to combat lost circulation difficulties. The terrain at South Mountain is extremely rugged. "Islands" were excavated from the side of the mountain at specific points and as many as six wells were directionally drilled from each "island." Surface formations were volcanic and highly porous and creviced. Drilling with conventional methods proved extremely difficult because of the excessive loss in circulation. In one well, cracks and fissures had to be cemented off six different times to conserve expensive mud. Drilling with cable tools, even if practical, would have proved uneconomical.

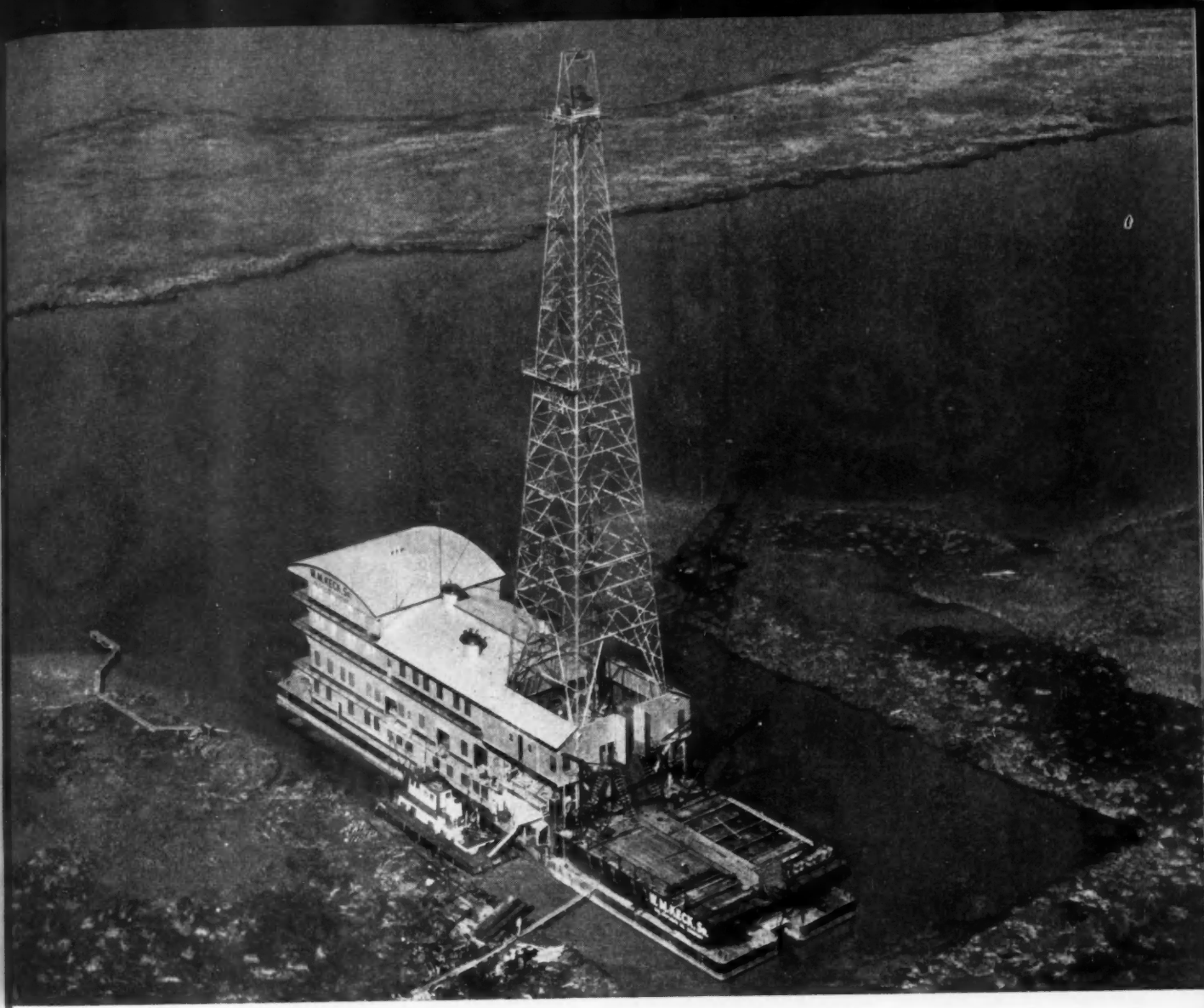
In resorting to the air technique, the operator assembled nine compressors supplying a volume of 4180 cfm and the air was forced into the drill pipe to the bottom of the hole under approximately 100 psi. As it escaped from the bit, it expanded, cooling the rotating tools, picking up the cuttings and bringing them to the surface where they were expelled through a flow pipe under the floor of the rotary drilling table. More than ten wells were drilled successfully by air from three "island" locations at an estimated saving of 50 percent over the proposed cable tool method.

But here again excessive dust proved a serious problem. A kelly packoff was designed to seal the annular space between the kelly and the adjacent casing string above the flow pipe through which the air and cuttings were now forced out to one side of the derrick and away from the crew. This packoff assembly consisted of three 8¼-inch outside diameter rubber pipe wipers with a 5¼-inch square hole in each to fit around the 5¼-inch kelly. These rubbers were confined by two 1-inch steel plates, with outside diameters smaller than that of the wipers, and the dimensions of the inside square hole slightly larger. This assembly rotated with the kelly inside the casing string allowed little or no dust to escape upward to the derrick floor. (Figure 1.)

Conclusion. Drilling with compressed air as the circulating medium is relatively new and poses many problems. So far it has proved most effective in hard rock country. However, because of its inherent advantages, its application in areas of unconsolidated formations should be studied carefully. Standard equipment and operating procedures certainly will assist in arriving at more efficient and economical methods for utilizing this promising technique.

ACKNOWLEDGMENT

The above article prepared for World Oil is based on a paper entitled: "Rotary Drilling by Compressed Air." It was the award-winning essay at the University of Tulsa in a contest sponsored by Lane-Wells Company in which advanced students in all of the country's petroleum engineering schools participated.



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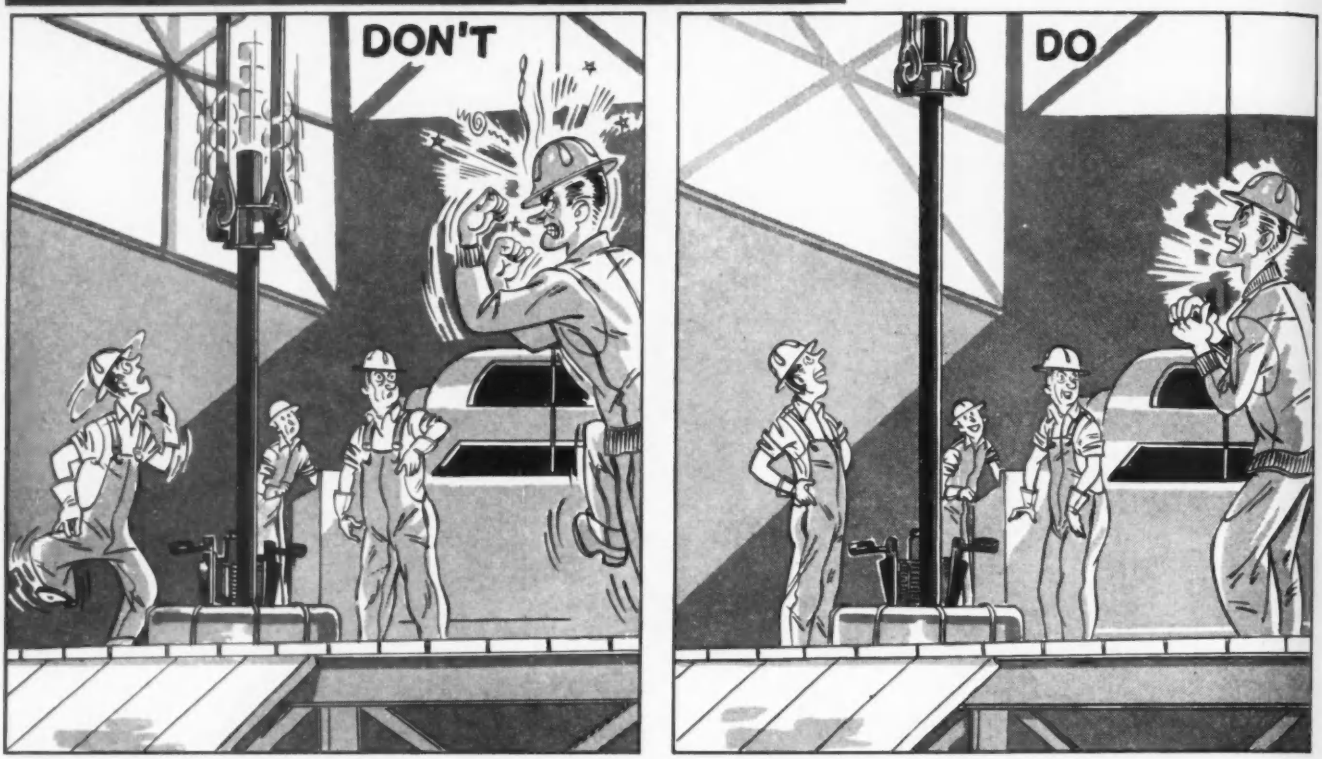
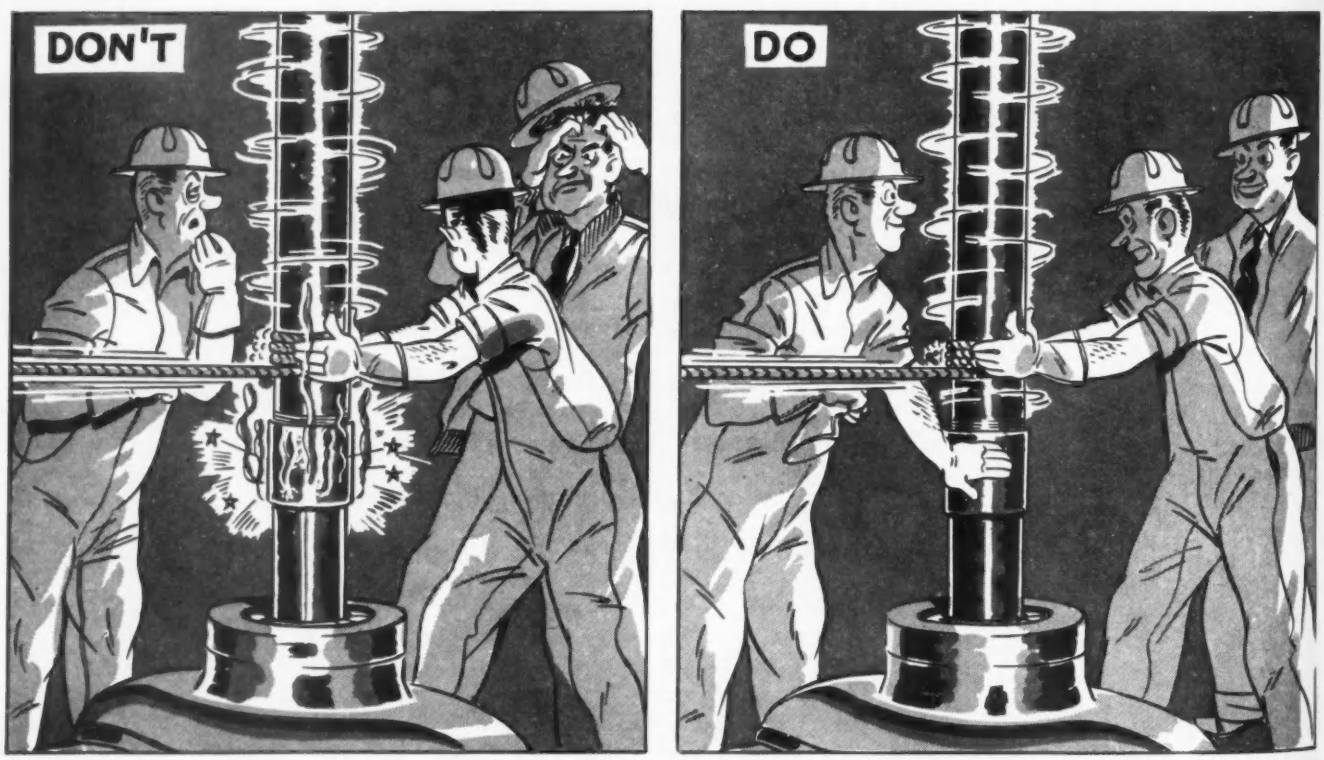
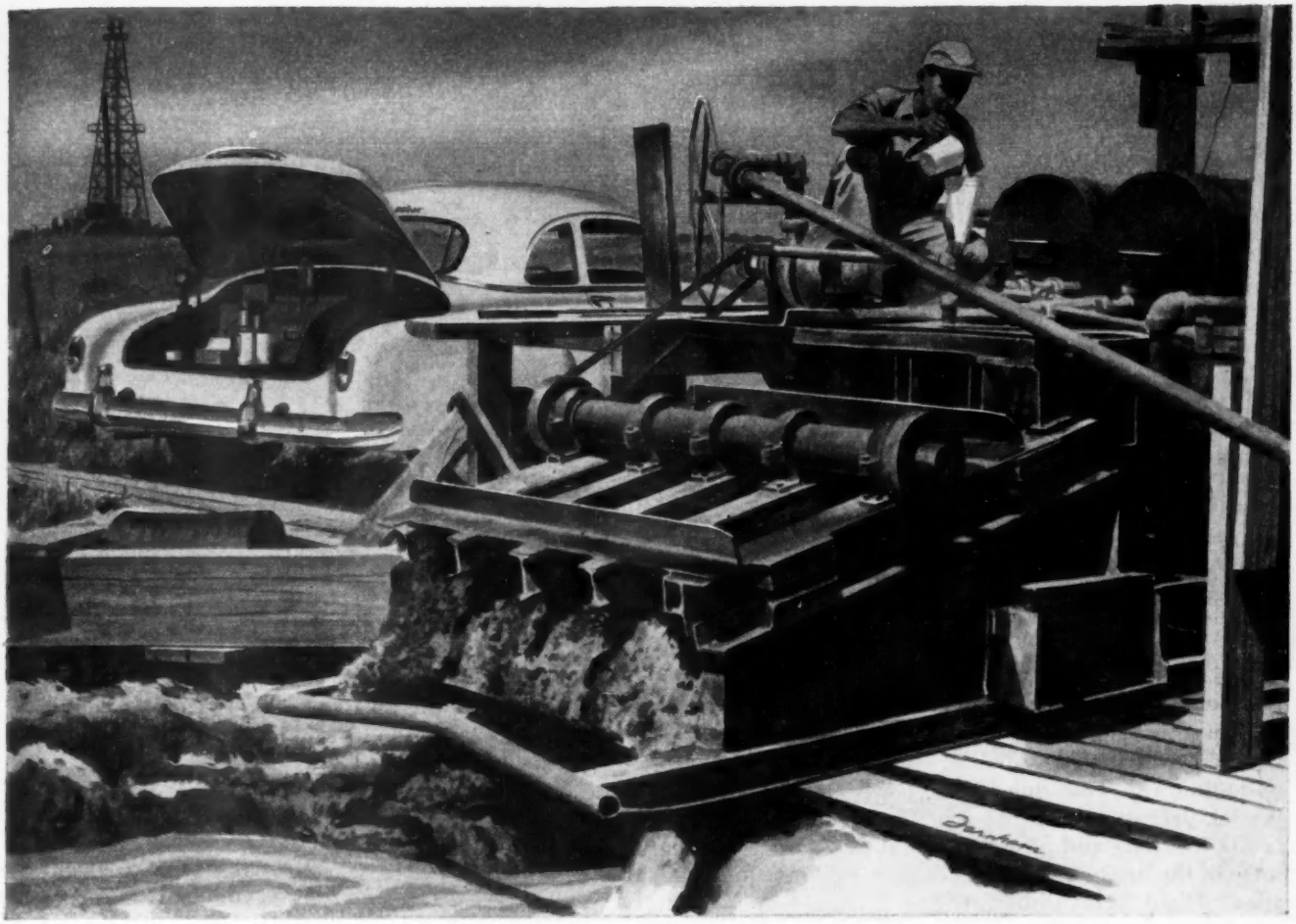
Drill Pipe And Casing Care



Too rapid lowering of drill pipe, besides being possibly injurious to string, causes pressure surges which can cause lost circulation in critical fractured or porous zones.



Hot spots or too rapid heating of casing coupling indicates galling and possible poor joint. Uniform, warm-to-hand temperature rise indicates normal makeup.



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1 Drilling progress at its best. That's The Superior Oil Company's drilling barge W. M. Keck, Sr. At left the barge is drilling in inland waters 23 miles south of Dulac, La. It is said to be the world's largest and most up-to-date rig. Towering 245 feet above the water, the derrick permits pulling five joints in a stand. The barge is 237 feet long and 54 feet wide. It has four decks and some of the most efficient and flexible drilling equipment afloat. Night lights illuminate the barge, (right) which can bed down 44 crew members. Living quarters are on the fourth deck and part of the third deck; office, mess hall and galley are on third deck. All are air conditioned and soundproofed. Power for drawworks is also on third deck. The second deck contains the power for mud pump engines, generator room, mud room, change room, laundry and pipe rack. Main deck consists of mud pump room, keyway slot, welding shop, cooling system, storerooms and reserve mud tanks with ballast tanks below deck.

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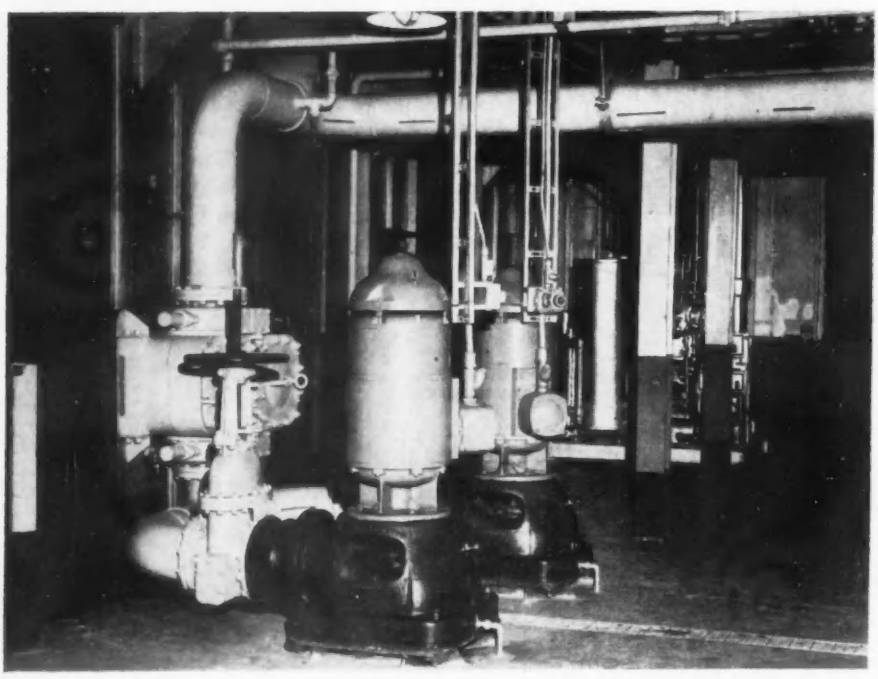
The Superior Oil Company's drilling barge W. M. Keck, Sr., is unsurpassed for size, convenience and the best in equipment.



By PHILIP L. McLAUGHLIN
WORLD OIL Staff

. . . the main deck

2 Two submersible turbine pumps are used to circulate salt water through heat exchangers to cool engines. Smaller pumps are used to circulate fresh water used in cooling fluid couplings, torque converters and auxiliaries. Water distillation unit at right turns sea water into drinking water at rate of 40 gallons per hour. Ballast, drinking water, and fresh water cooling tanks are arranged conveniently below decks.

■ CONTINUED ON PAGE 166

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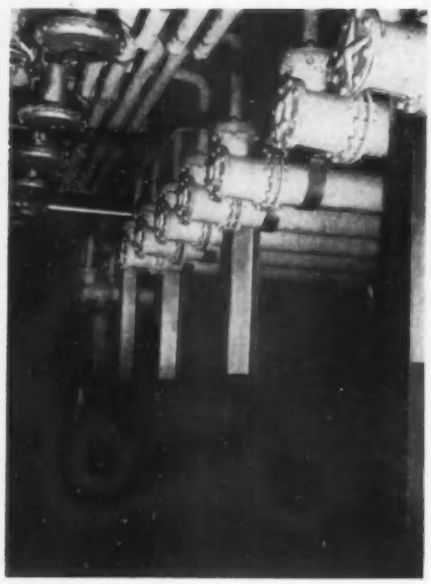
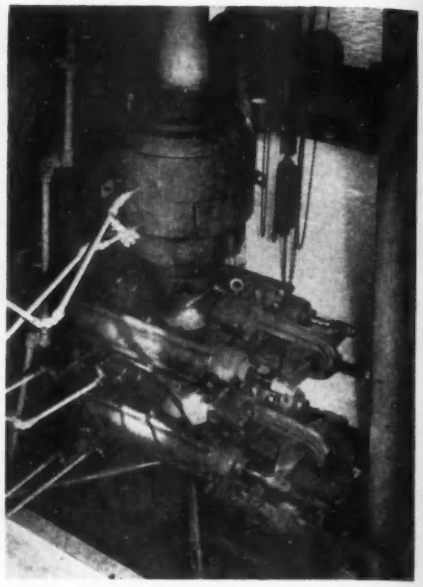
efficiency afloat



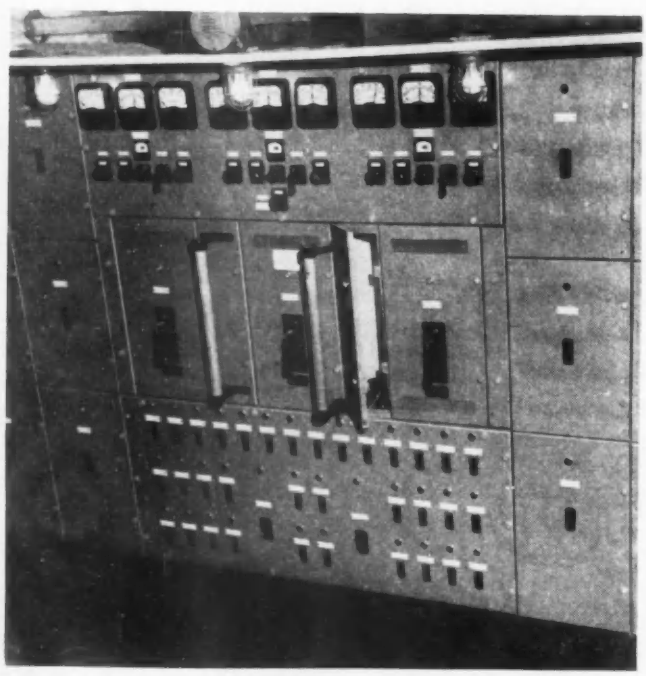
3 The heat exchanger is mounted in the ceiling. It provides cooling water for nine engines and and several torque converters. Temperature control valves at left are used to regulate flow of coolant to engine.

4 All the comforts of a floating hotel. This elevator provides easy access between the various decks of the barge. Here a box of supplies is pulled into the lift for a quick trip to an upper deck.

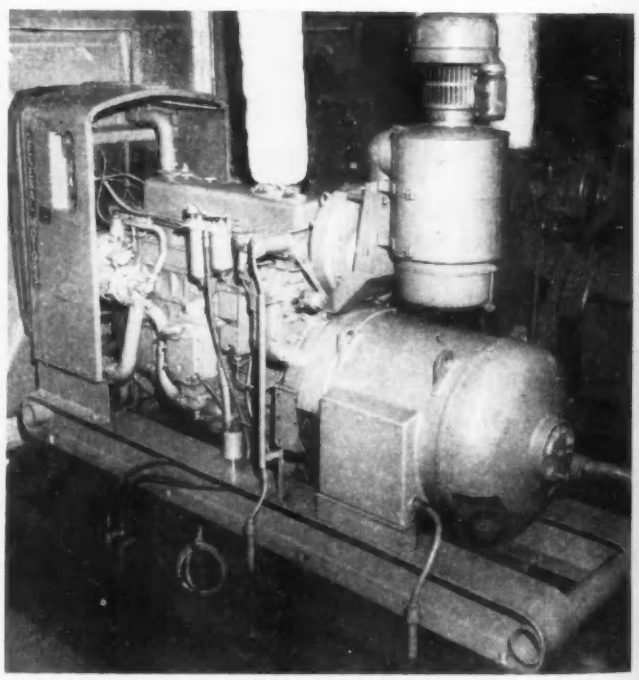


5 Clearance between derrick floor and main deck leaves enough room for dual completion blowout preventer for any emergency. The 20-ton preventer assembly can be moved as unit on trolley hoist at right.

the second deck



6 The main switchboard resembles the control panel of a large power plant. Warning lights and horn are shown. All air entering area is passed through the switchboard to remove any accumulation of explosive gases.



7 Generator room includes three 100-KW diesel generator units and a 300-ampere welding machine. Generators can be operated via remote control devices at master switchboard. Plug-in points for electric and acetylene welding are at key points.

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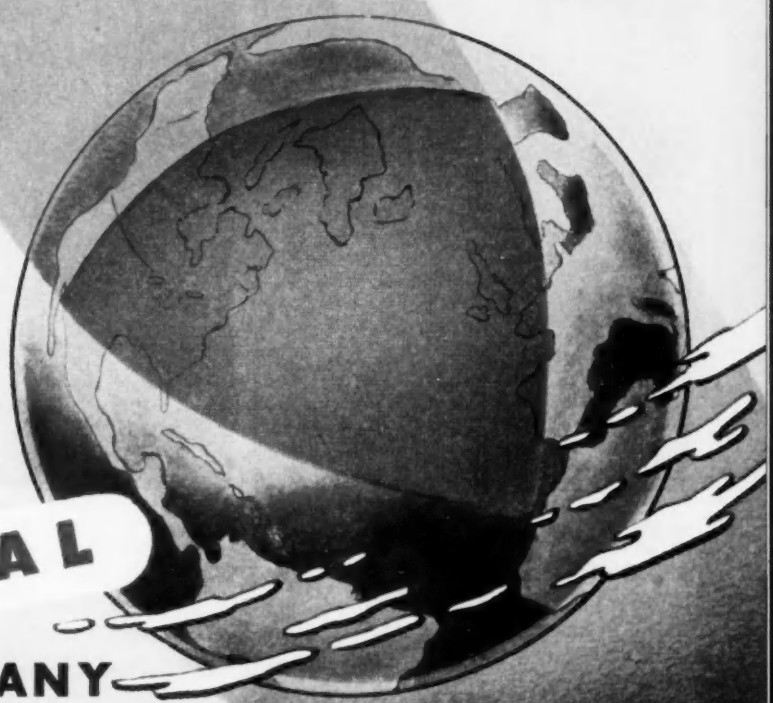

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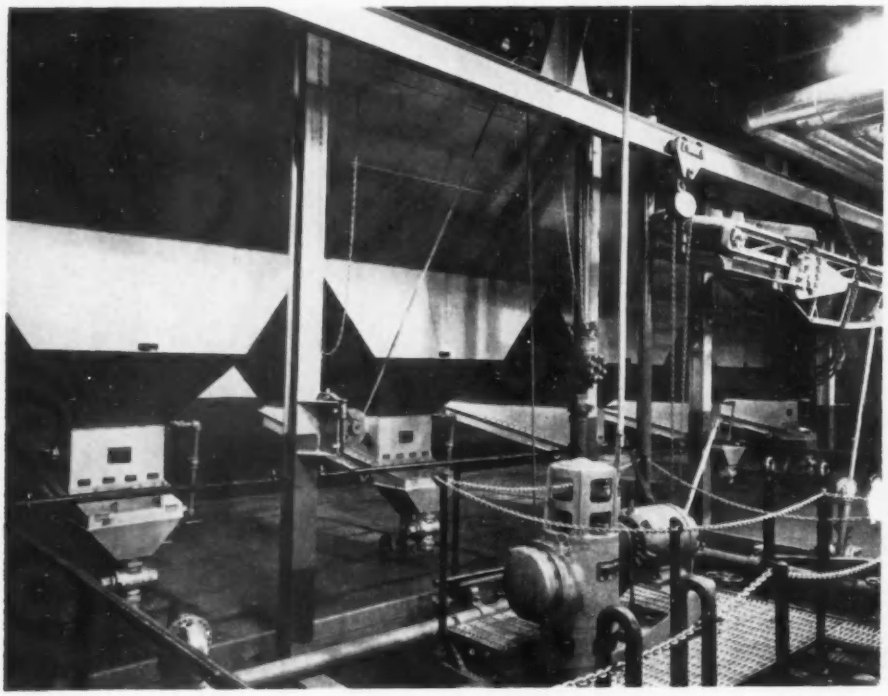
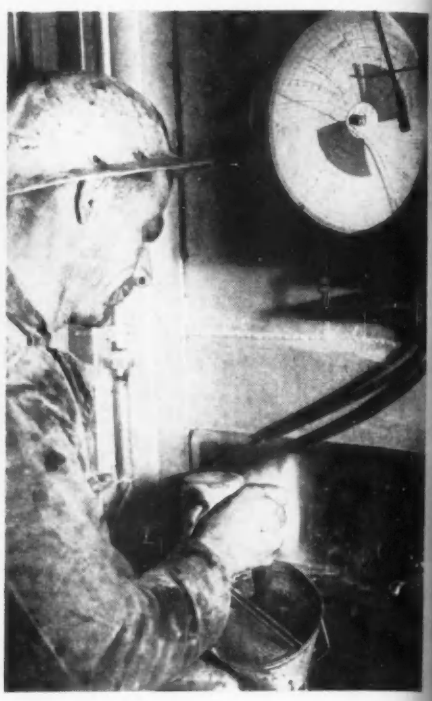
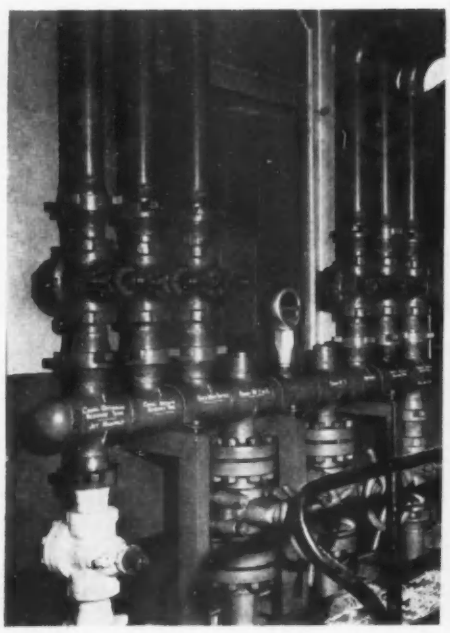


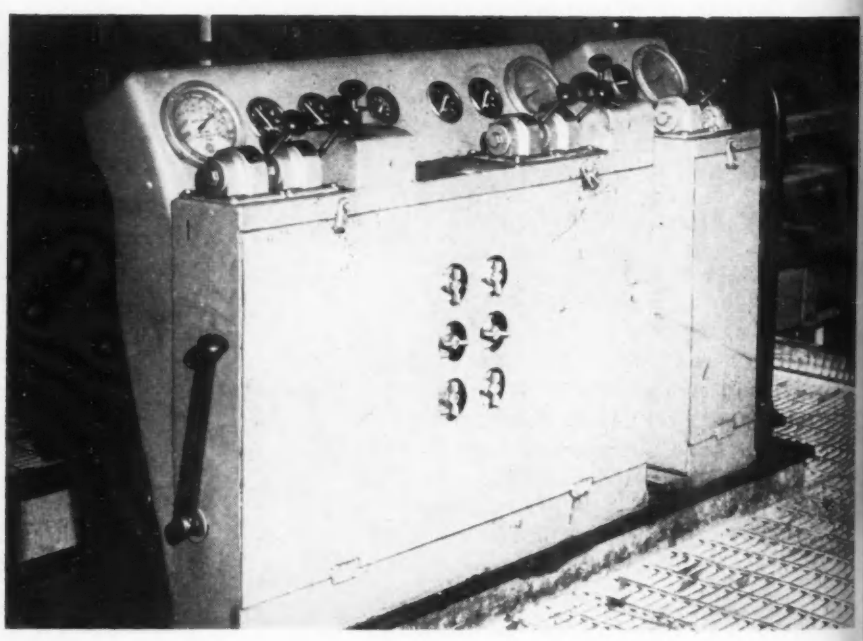
8 Storage system, active mud tanks and mixing equipment are outstanding features of mud room. Two active mud tanks, 10 by 20 feet and 10 by 17 feet and 11½ feet deep are agitated continuously by direct drive impeller-type mud mixers in foreground. Bulk mud storage system in background has a 4400-sack capacity, feeding through five hopper compartments with graduated flow of ½ to 4 sacks per minute. Note emergency belt conveyor suspended from monorail at upper right.



9 The barge's mud laboratory is equipped with constantly recording mud instruments that are used in conjunction with standard testing equipment. A similar recording device at the driller's console provides mud information at a glance.



10 Mud manifold arrangement has been marked to insure accurate routing of mud to various parts of the barge. This valve arrangement offers great flexibility.



11 Here's the versatile pump room console. Any combination of engines can be put on one pump. Console is arranged so that pump controls can be switched to minimize the danger of trapping a man while working on the pumps. The driller's cabinet is on the deck above.

■ CONTINUED ON PAGE 172

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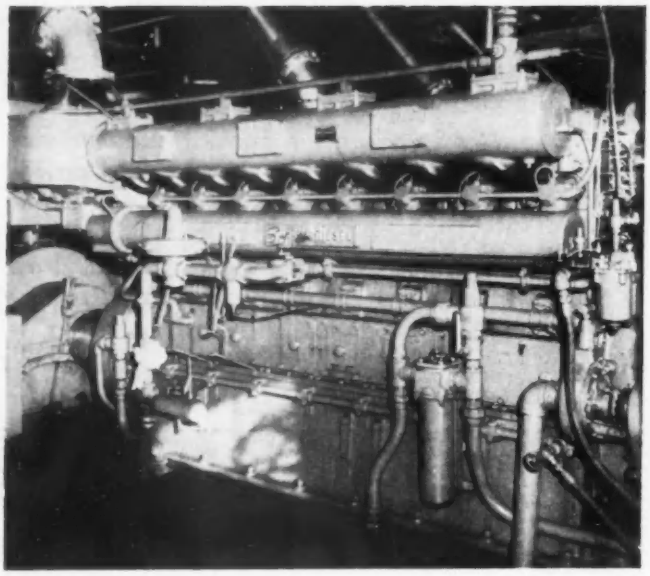
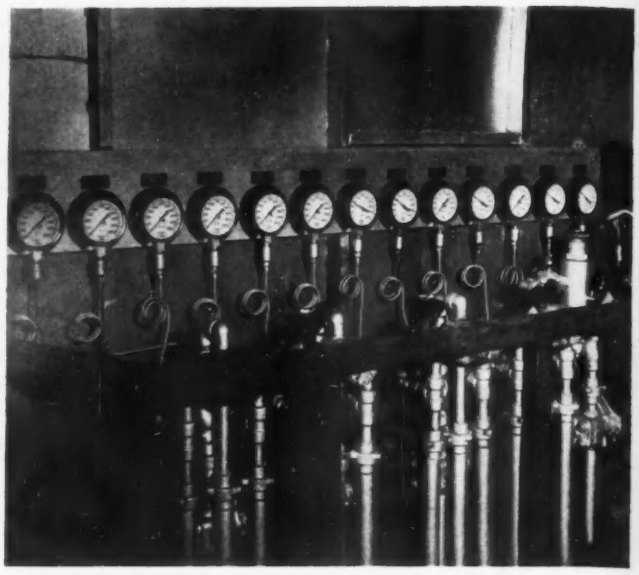
the third deck



12 Three shockmounted engines of this type are compounded with independent drive to supply 1950 brake horsepower to drawworks. All major equipment is mounted on rubber pads. Set of four diesels drives two 700 hp mud pumps through rubber-in-shear couplings.

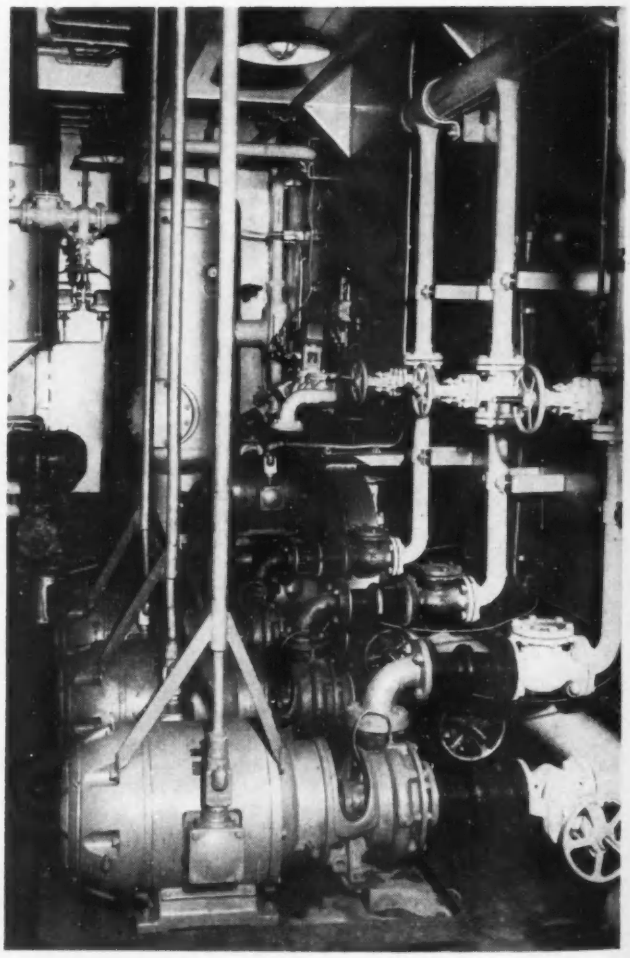
efficiency afloat



13 The blowout preventer controls are compactly arranged and located convenient to the driller's position. Two 80-gallon accumulators are placed a few steps from the office entrance.

the fourth deck

14 The spacious lounge for the crew is finished in mahogany and equipped with desks, card table, plushy leather chairs and a television set. It's a popular place during off-tour hours. Doors in background lead to crew's quarters and bath rooms.



below deck

15 Fresh water and fuel pumps are located below the main deck.

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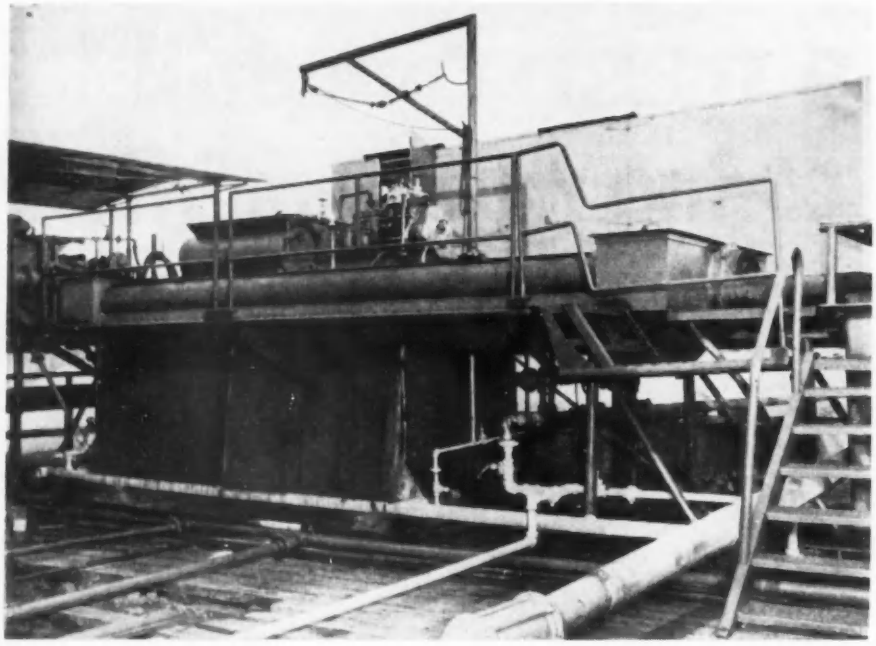

FIGURE 1

Over-all view of trap which incorporates hinged walkways, jets, chemical circulating system and chemical storage space. Flanging to the shale shaker and first tank, complete hookup requires coupling of just a few unions.

Here's How to Rig a Unitized Trap

This assembly is designed with elevating chemical feed system while each skid base is a water or steam carrier.

By W. L. BROUSSARD
Drilling Tool Foreman, Magnolia Petroleum Company

USE OF A temporary, wooden flow line and trap system serves the purpose of routing mud from the shale shaker to the shale pit or tank; however, the complexity of Gulf Coast operations dictates the need for a dual purpose, compact and completely unitized trap assembly. Were it not for the fact that mud must be chemically treated, bypassed or that sand and other high specific gravity solids must be removed from the fluid, the importance of an efficient, flexible trap system could be discounted. However, since each of the above operations is a day-to-day routine on the Gulf Coast rig, the smart operator will provide adequate and convenient equipment lending to the speedy completion of these important jobs.

To insure the completion of a decent, well unitized system, a number of trap layouts were inspected along the coastal region and the illustrated equipment seems to represent a composite idea of how a trap assembly can be rigged to provide many conveniences plus fast operation.

All Space Utilized

Figure 1 shows the manner in which each inch of space has been put to work in the system. For example, even the long skid runners carry either steam or water. In turn, the complete substructure is boxed to provide storage space for fragile mud chemicals. This inexpensive idea eliminates the need of a special storage house for mud chemicals. An added advantage is that the mud chemicals are conveniently located for handling with the block and tackle rig.

The system's height would present a problem in rig transport; thus, the block and tackle support is removed by breaking a union while the chemical pump and tanks lower into the mud storage space. Further streamlining is accomplished by lowering the hinged walkways extending along either side of the unit.

The dual trap system, composed of two joints of split and welded casing, permits the removal of high specific gravity, foreign solids from the mud. Once the trap is filled with such foreign matter, the control gate is locked in place and the mud stream is diverted through the second flow line. Removal of trapped sediment is accomplished by opening a four-inch jet welded in the box base. Further advantage is offered by the jet system since, when the choke lines are connected to the flow line, immediate removal of cut mud is possible by bringing the jet system into play. If a well is washed-in with water and it is desirable to block its entrance into the mud system, the above operation can be used to divert wash water into the

reserve pit. This operation plus the matter of routing cut mud to the reserve pit eliminates the necessity for laying additional temporary lines about the location.

Chemical System Efficient

Extended use of lime base drilling fluids in the coastal area presents a problem in that it is quite difficult to restrict lime settling in the mixing barrel. Of course, the accurate introduction of lime solution is basically essential to mud system stability; hence, the circulating system, shown in Figure 2, plays an important role by maintaining concentrated lime solution in the chemical dispenser. The circulating system offers further assist in sodium base muds where frequent addition of phosphate is required. Blending this type compound in hot or steaming water has a serious effect and it is a prerequisite that the material be mixed in relatively cold water. By first mixing the compound by some mechanical means and then circulating with the illustrated pump, the solution is blended more effectively and waste is reduced to a minimum. A manifold system between the pump and chemical drums permits variable steam-fluid control.

Water and steam valves are attached to the sides and base of the two feed barrels so that the fluid level can be maintained and some chemicals can be steam rolled for complete mixing. Smaller control valves adjust the rate of chemical feed into either or both flow lines. Splash aprons surround each chemical tank while one is rigged with a metal sack rest.

Since often it is necessary for crewmen to handle heavy containers of chemical or mud additives, the simple block and tackle assembly is spotted in a position where it can be swung around to pick up material from ground level and moved to a point immediately above the chemical barrels. This inexpensive device permits handling chemicals with ease and safety.

Safety Devices Plentiful

Handling certain mud chemicals, such as caustic soda, is often a dangerous procedure. For this reason, not only splash aprons but wash water outlets are installed within the vicinity of the mixing barrels. If a crewman does come in contact with a caustic solution, convenient water outlets permit their immediate removal.

Each mud trough is covered with a hinged, expanded metal lid which blocks entrance of foreign matter into the mud and protects crewmen from hot mud burns. Hinged guard rails enclose the skid proof walk-ways.

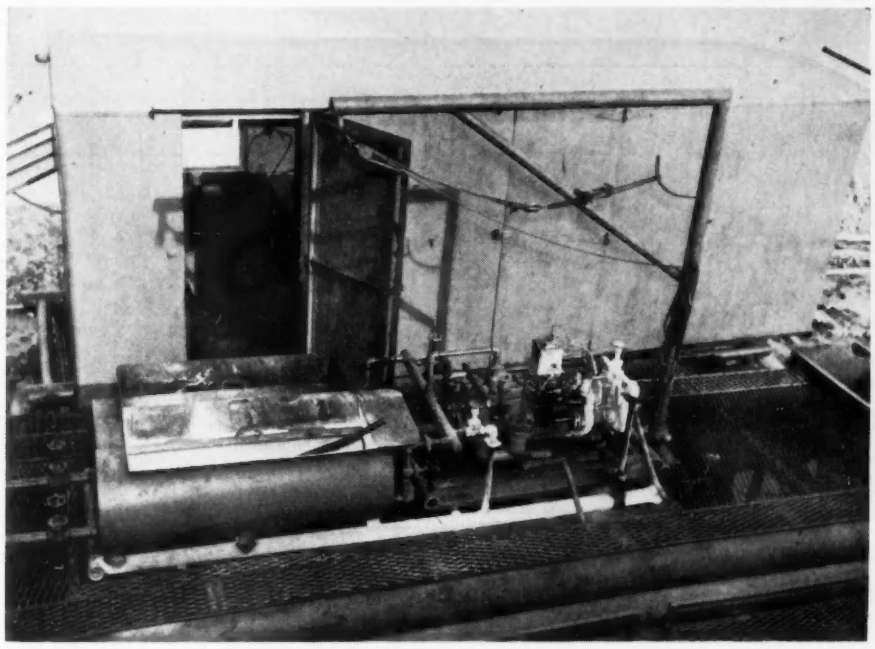

FIGURE 2
Use of relatively insoluble fluid chemicals prompted installing a steam circulating pump which keeps compound solutions in motion at all times. Pumping unit and tank assemble bed within substructure for rig moves. Pivoting block and tackle support permit easy chemical drum handling.

Base Structure Detail three and four-inch pipe are welded together to form a 7 x 20 foot substructure. Each of the four corners is diagonally braced and three vertical supports are stationed between the end legs. The unit vertical dimension will be governed by the shaker outlet height and the top flange of the shale pit. It will be noted in Figure 4 that the legs and vertical supports are anchored in an angled position to reduce the top dimension but yet provide a mud chemical storage area. Figure 3 shows that the storage unit siding extends from the shaker past the third vertical support since space must be allowed for jet fitting, steam and water connections, fastened to the pit end of the structure.

Two-inch pipe frame walkways are then formed, covered with expanded metal and pin hinged to the vertical substructure supports. The walkways are blocked in a flat position with hinged, three-eighths inch supports anchored to the side of the substructure.

Casing Trap and Flow Line. The mud ditch is made of 16-inch while the sand trap is cut from sections of 20-inch casing. The flow line is ripped from end to end on both top and bottom, then a length-wise gap is cut atop the 20-inch sand trap. By fitting and welding the 16-inch casing segments alongside the gap in the trap, the combination assembly is completed. Detail of the installation is shown in Figure 4. Three-inch pipe is used to bridge the space between the two completed trap flow lines and the structure is lifted to rest between the support legs.

Unit Well Braced

Welding the trap sides to the substructure legs provides a sturdy unit sufficiently braced to withstand abuse in transport.

Each end is fitted with a common box guiding fluid from the shaker into one flow line and finally spilling into the shale tank. The size of these boxes will depend upon the distance the two lines are spaced apart. The illustrated unit contains boxes 2 x 2 x 7 feet, sufficiently large to allow gate installations and still keep mud from slopping over the sides. Four-inch jet systems deliver residue from the pit-end box to the reserve pit. Either narrow gauge channel iron or metal strap will serve as door guides. Particular attention must be given structural detail of these two boxes as they alone control fluid flow through the combination flow line-trap system.

Chemical System Design. The three-inch pipe skids supporting the chemical barrels and the mixing pump are rigged to carry steam on one side and water on the remaining side. Outlets feed steam to both the chemical tank bases and the steam operated mixing pump. The two-inch manifold between the pump and tanks permits circulating chemical or feeding steam or water into the tank. Aside from offering the advantage of

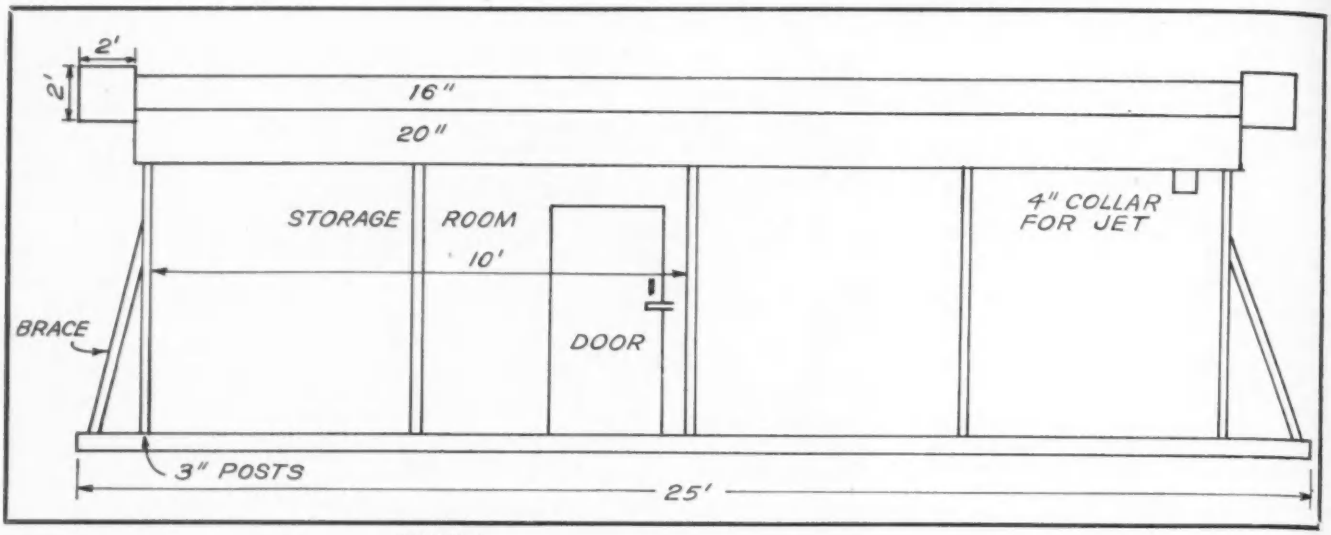

FIGURE 3
Schematic outline of basic dimensions and structural features of trap assembly. Strict conformity to this plan may not be possible since rig layouts differ radically. However, these basic dimensions will aid operator in construction of unit.

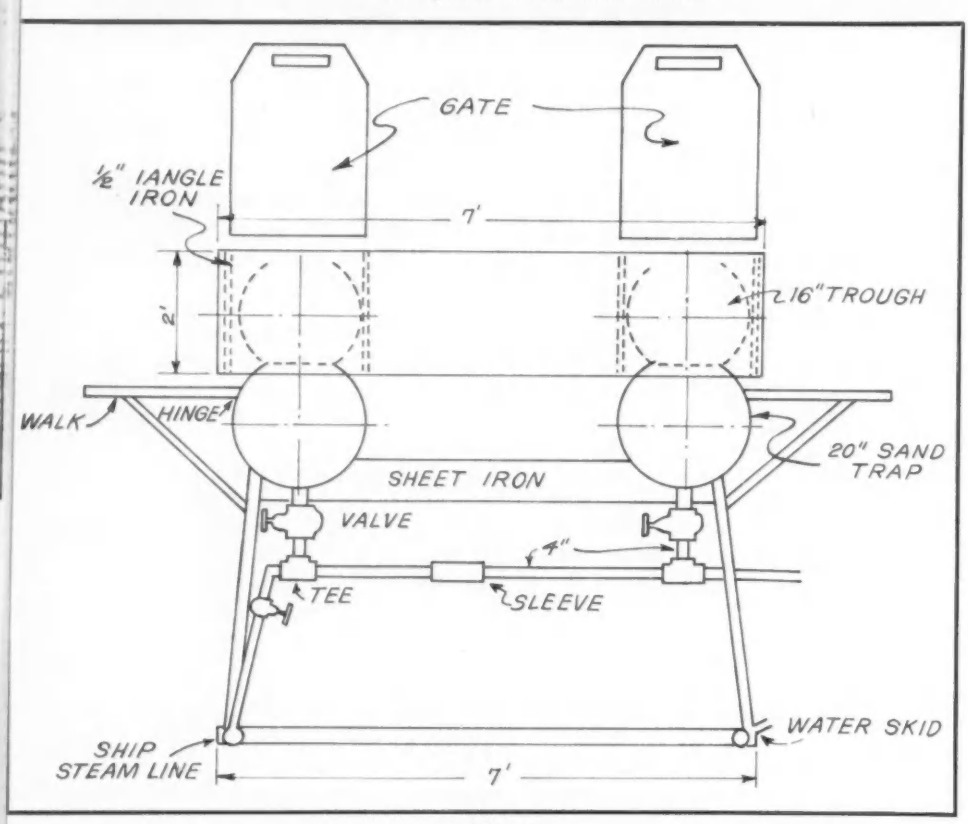

FIGURE 4
End view showing flow line and trap detail. Two flat iron gates are invaluable aid in bypassing fluid for disposal to reserve pit or cleaning loaded sand trap. Each horizontal skid member routes steam or water to strategic points in system.

rolling solutions, the pump manifold permits pumping large fluid volumes into the tanks prior to mixing a fresh batch of chemical.

Pin-anchored beams support the chemical barrels and pump unit so, for long highway moves, the beams can be removed and the entire unit lowered into the mud storage house.

The area surrounding the chemical system is covered with non-skid expanded metal to permit safe working conditions and an easily cleaned surface.

Minimum Piping Requirements

Since each major skid member acts as a fluid or steam carrier, the piping requirements for the unit are held to a minimum. One inch steam feed lines for the pump and chemical barrel extend from the unit skid base to the chemical unit skid base. From this point, the steam and water are distributed through additional one-inch lines. Adequate valves and unions are placed in the system to permit complete water-steam control or line breakdown when repairs are necessary.

The four-inch jet line system is reduced to two-inch at one end of the horizontal manifold and the remaining end flanges to a four-inch line leading to the reserve pit. An expansion sleeve is placed in the middle of the manifold to compensate for line movement.

Diagonal steam-water feed lines extend from one unit end to operate the shale shaker. These lines are uncoupled and swung back against the unit when the rig is dismantled.

The streamlined piping system permits rapid rigup practice since there is just one steam and water connection to be coupled in preparing the unit for operation. Completion of assembling includes coupling the jet line and shaker system. In event the chemical system is not lowered into the storage house, connection requirements are further reduced.

Elaborate connection work on each end of the unit is eliminated as the shale shaker spillway is slightly higher then the flow line box while, on the remaining end, the gathering box is slightly higher than the top edge of the mud tank.

Welding time is the greatest expense involved in the construction of the complete unit. A majority of the metal components were salvaged from discarded equipment, thus a minimum of new materials was used. Even though the initial cost is considerable, complete unit payment is possible after a few rig moves. Of rugged construction, proper care in use and caution in handling during moves will result in many years of highly satisfactory service.

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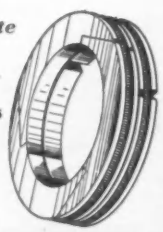

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Heated Shelter Will Protect Derrick Man

AN ELECTRICALLY-HEATED, self-contained shelter for the derrick man is paying substantial dividends for one company drilling in the central Alberta area. When temperatures drop to 40 degrees or more below zero the endurance of the derrick man can be understandably limited, even though he may be dressed in the warmest possible clothing. A small shelter into which he can retreat for brief periods whenever there is a lull in pulling operations, can go far toward easing his discomfort.

Even aside from the desirability of affording all possible comfort to drilling personnel, there exists a very substantial monetary reason for providing such a shelter for this key man of the drilling crew. Without any shelter or source of heat, and during such a severe cold period, the derrick man probably would have to come down to the floor to get warm from time to time. And if pulling or running-in operations were underway, such operations would come to a halt for a short while. With drilling rig operating costs running at somewhere between $2500 and $3000 per day, such stoppages of work, occurring perhaps several times during the day, easily could mount to an appreciable loss of time and money.

The shelter shown in Figure 1 actually was not yet equipped with the electric heater nor was it equipped with the heavy canvas curtain that normally would be drawn across the 18-inch wide opening. However, the general size and shape of the unit may be readily seen. Of all-welded sheet steel construction, the shelter is six feet high, four feet wide and 28 inches deep. Corners, and edges of the doorway, are re-inforced with angle iron to give the unit rigidity and protection against the rough handling that might be encountered when moving between locations.

FIGURE 1
Size and shape of heating unit. Steel loop welded on top makes moves easier.

A round steel bar loop welded to the center of the top surface facilitates raising and lowering the unit in the derrick; also assists in the handling of it by the winch truck at rig-moving time. The bottom of the unit is floored with sections of plywood to provide not only a more non-skid surface, but afford some insulation against the cold steel flooring.

Aside from keeping the derrick man warm and protected from the cold during lulls in pulling operations, the heater inside the unit serves still another function of importance to his comfort and efficiency. The derrick man, by keeping two pairs of gloves on hand, always is assured of having available a pair of warm dry ones when handling a string of wet or muddy drill pipe. While he is working outside, the previously worn pair can be inside on the heater drying out and warming for quick exchange when needed.

The cost of constructing and equipping such a shelter easily can be repaid in a comparatively short while when drilling in very cold climates.

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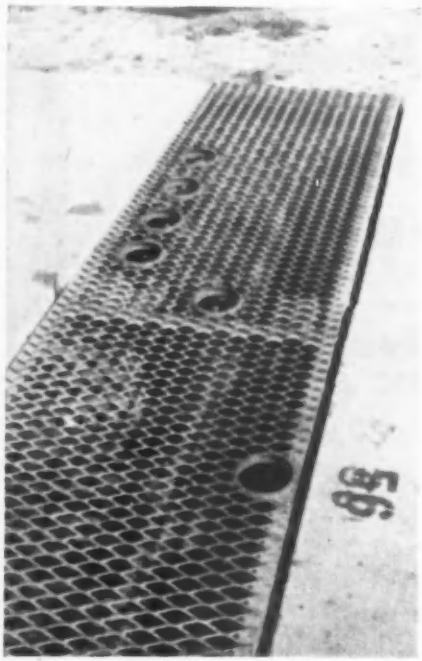
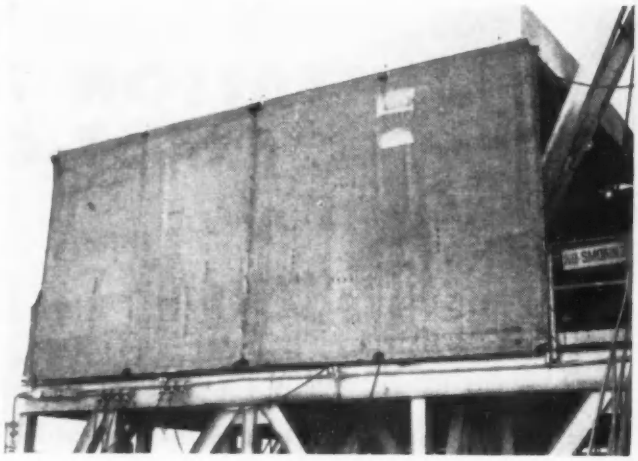


Holes Are Cut In Trench Cover

On locations where wells are closely ground-spaced for whipstock operations, trenches have been constructed with concrete walls and pavement connecting and trenches filled with service pipe lines. Trenches in this area are covered with diamond-shaped expanded metal. Gate valves and plugs normally are placed in various lines for control purposes so that the covers must be lifted each time a gate is opened or closed. Holes are cut in the trench cover for operating the gates through these holes.

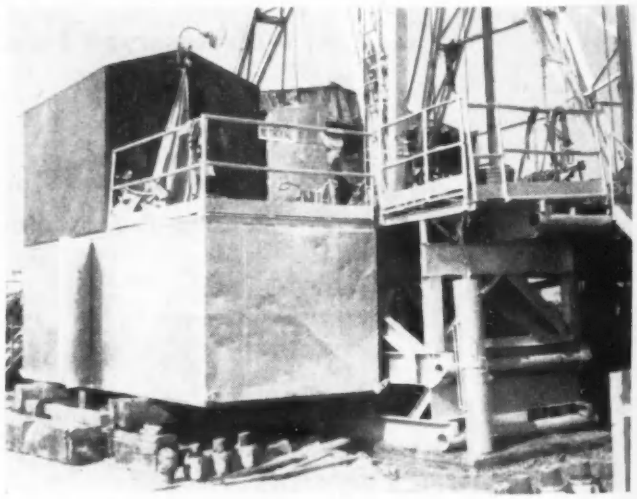
Instead of running a bead around the circular hole cut in the grating, these openings are finished with discarded thread protectors. The protectors are placed with the belled or smooth end uppermost with the edge approximately flush with the grating bars. While these holes are left open, none is large enough that a man might step through.

Tarpaulin Curtains Are Durable



A contractor has been using the same tarpaulin side curtains on one of his rotary rigs for two years with a minimum amount of damage. The "mint" condition of the curtains is maintained by attaching to the curtain edges round rollers which are fastened to the roof edge with hooks. Similar hooks attach the curtain to the floor edge when the tarpaulin is brought down in operating position. Matching edges of adjoining curtains are fitted with grommets for lacing together with heavy cord to prevent flapping and subsequent tearing of the fabric. The curtains may be separated and removed or rolled on the bottom rod when the weather permits.

Doghouse Rest on Toolhouse



Using the tool house as a substructure for the derrick doghouse has become standard practice for a contractor in California. The tool house is a rectangular, box-like building set on the conventional skid base members. The roof is flat and made of substantial tank steel so as to support men and material. The doghouse is set on one end of the roof and the opposite end is fenced with safety rails and used largely as a repository for bits, subs and small tools. Being level with the derrick floor, these pieces of equipment can be reached with a minimum amount of effort.

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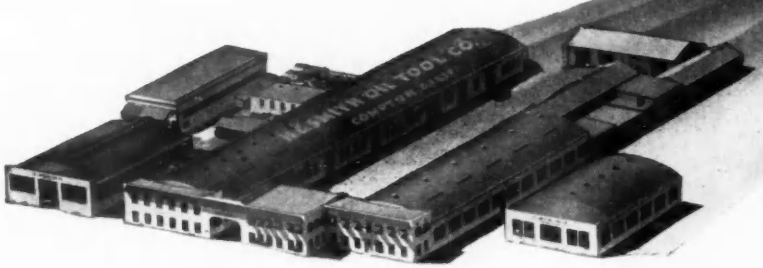

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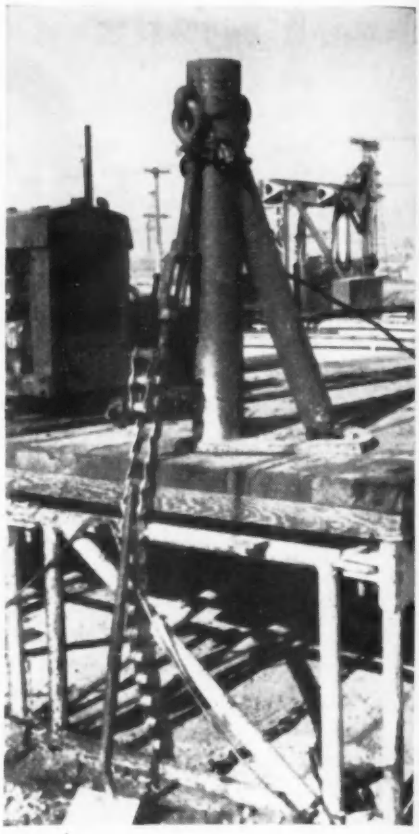
To keep necessary small tools in working condition without being contaminated with oil or dust accumulated on the deck of an oilfield truck, a convenient rack is being used. A vertical skeleton structure, the rack is made of pipe and sucker rod, or concrete reinforcing steel with flanges on the lower end of the four corner posts for bolting to the floor of the truck bed. The top is a flat piece of tank steel with various sized holes into which the handles of the wrenches, brooms and shovels are inserted. Additional apparatus, such as hooks and crosspieces, are added to hang bridles and chains where they may be obtained easily.

Highline Post Made Of Pipe Is Sturdy

A sturdy highline post is being used which is made with a short length of heavy six-inch pipe as the standard and a convenient length of four-inch for a brace. Both pieces of pipe are welded to a triangular sheet of boiler plate with holes bored for lag screws to hold it firmly to the end of the walk between the pipe racks.

The top of the vertical post is provided with two eyes, one for the highline or snatch-block, and the other to receive the ring of a turnbuckle. The turnbuckle in turn is attached to a convenient length of discarded rotary chain, where lower end is fastened to the bottom rail of the walk structure, or to a sunken "dead-man."



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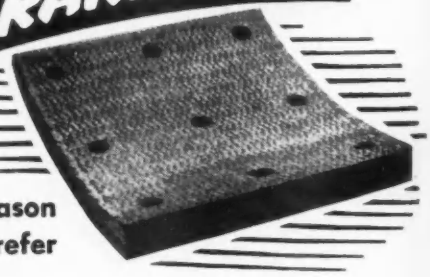

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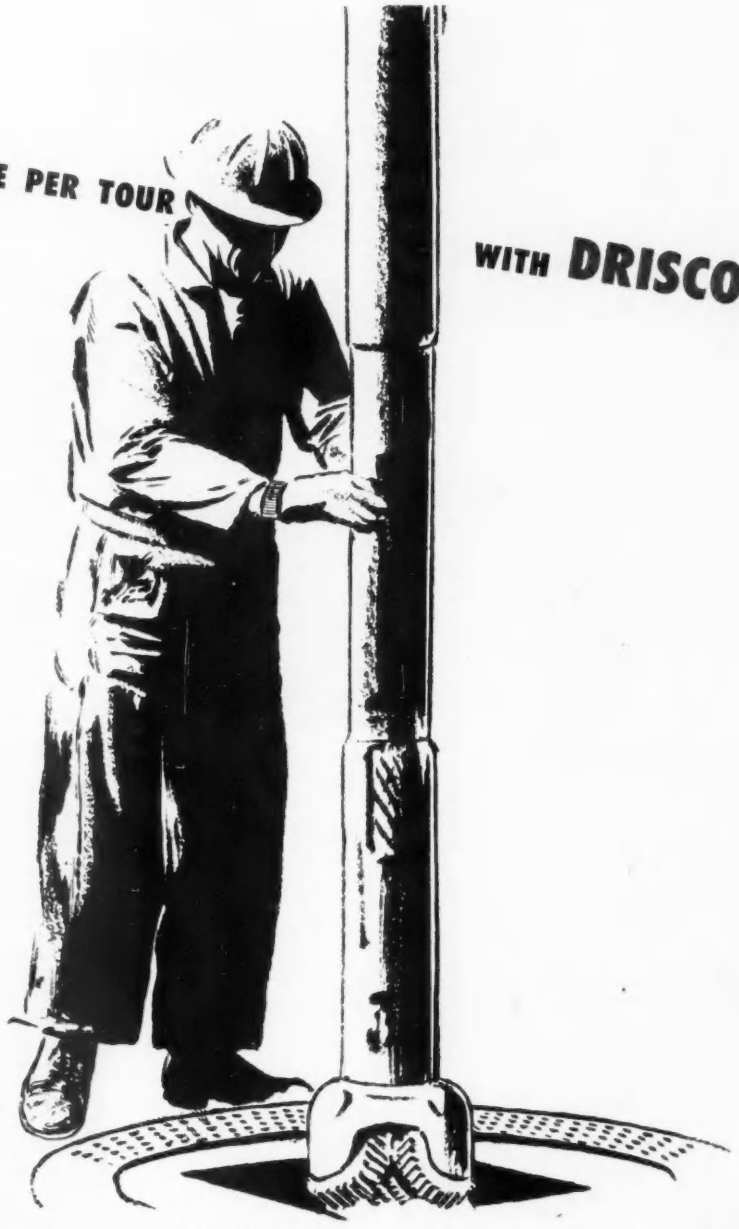

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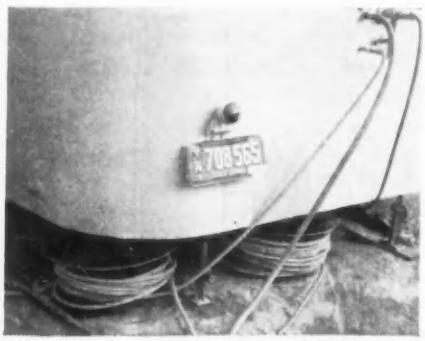
Wire Storage Spool Protects Excess Hose

Taking a tip from the boys who string high lines and telephone cables, a contractor has built, or obtained otherwise, substantial wire reels upon which the surplus length of this equipment is stored.

For example, if the house trailer for the pusher or lab man is placed near the rig, fuel, compressed air and power for lights and instruments are



led to the trailer and connected with approved fittings. Excess length of hose or cable is reeled upon these wire storage spools and laid beneath the floor of the building for complete protection. By supplying long sections of utility lines, the house car can be set at a convenient distance from the rig while the surplus length of cables and hose is fully protected.

Traffic Guides Used On Guyline Anchors

Since guyline anchors are spread widely from the base of a mast type drilling rig, there is always an element of danger of trucks inadvertently running into the anchor. Traffic guides

Traffic Guides

have been made up and attached to the anchors to prevent such occurrences. These guides are made by the tinsmith as box-like apparatus large enough that a reflector type signal can be placed on each of the four sides. The signal has a substantial bail at the top for a loop of soft line, or heavy cord which may be looped over the handle of the conventional chain tightener. The reflectors are the ones commonly placed on the tail gate of pickups which reflect the lights of head lamps with a bright red glow.

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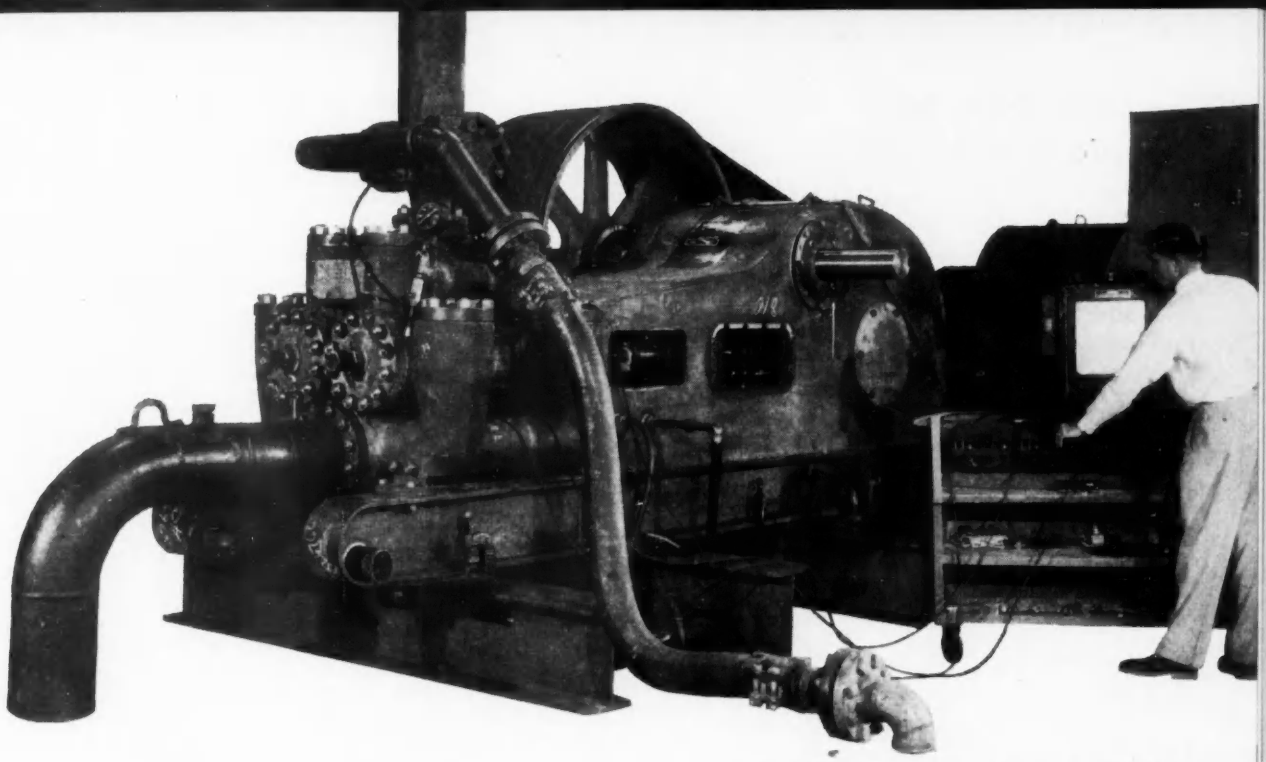

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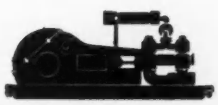

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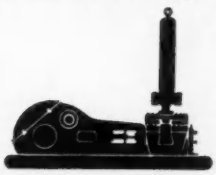

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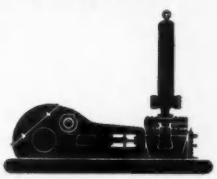

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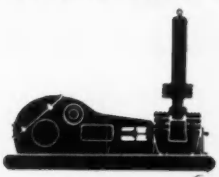

D-175: Hp. input, 175 @ 75 rpm.

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Compact Drum Rack Used on Drilling Rig

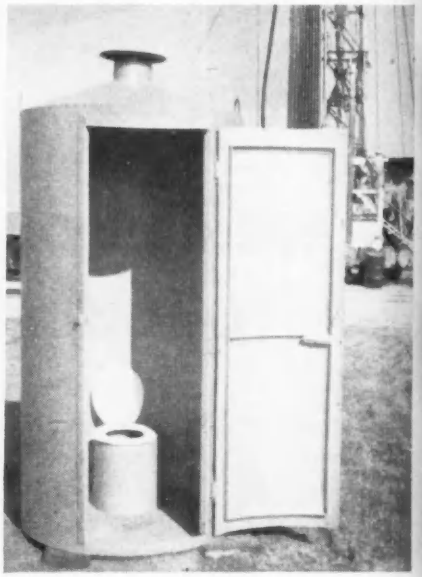
It is desirable for all equipment serving a drilling rig to be as compact as possible. For this reason the illustrated drum rack is practical, easy to move and takes up little space on location.

A single rack is made by welding two steel ¼ x 1½ inch straps between four upright pipes which are welded to a skid base. The number of racks can be extended as many times as is practical.

Skid mounted, the rack is rapidly loaded and hauled to a new location.

Cylindrical Toilet Built in Steel Unit

A cylindrical, sanitary toilet has been devised eliminating square corners at which dust and debris usually accumulate. This unit is all steel, being fabricated from lightweight tank sheet reinforced with angle iron at top and bottom, and having a shallow conical roof terminating with a covered ventilator. The door is a segment on hinges that fits snugly and locks from the inside with a sliding bolt. The floor can be easily swept out with a few whisks of a broom and has



ample room for one man. The unit rests on a few pieces of planking over the chemical pot set in an excavation in the usual manner.

Chain-Come-Along Tightens Guy Wires

In the Gulf Coast region one drilling contractor has adapted the chain-come-a-long method to tighten guy wires to the mud anchor. The mud anchor has been screwed into the ground to a considerable depth, and is held by the bearing plates which tend to prevent its being pulled up. Rather than employ clips or clamps, a connection has been made by splicing the end of the rope around a thimble. The efficiency of this splice varies with the diameter of the rope but is usually more efficient than the clip attachment.

The chain is hooked through the

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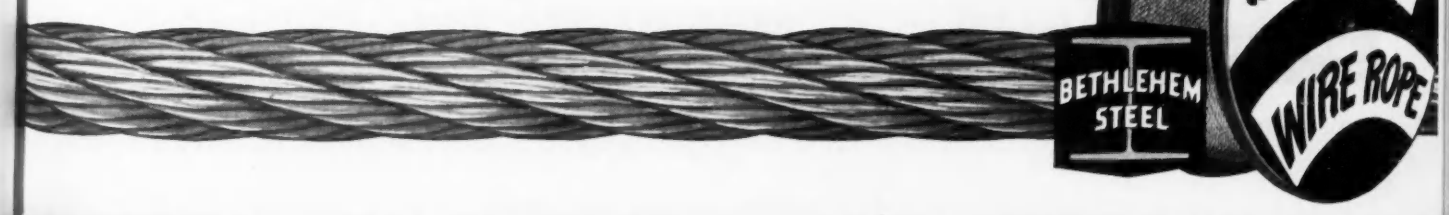

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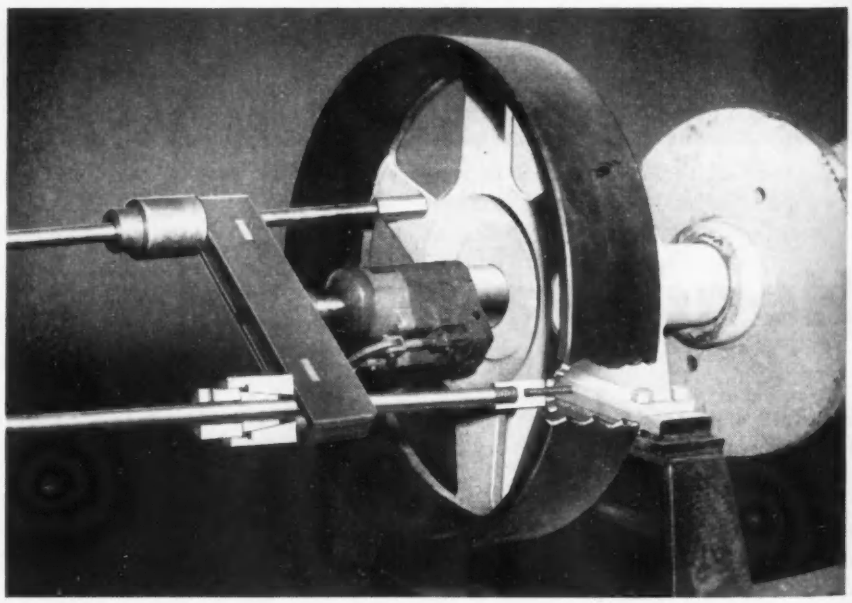

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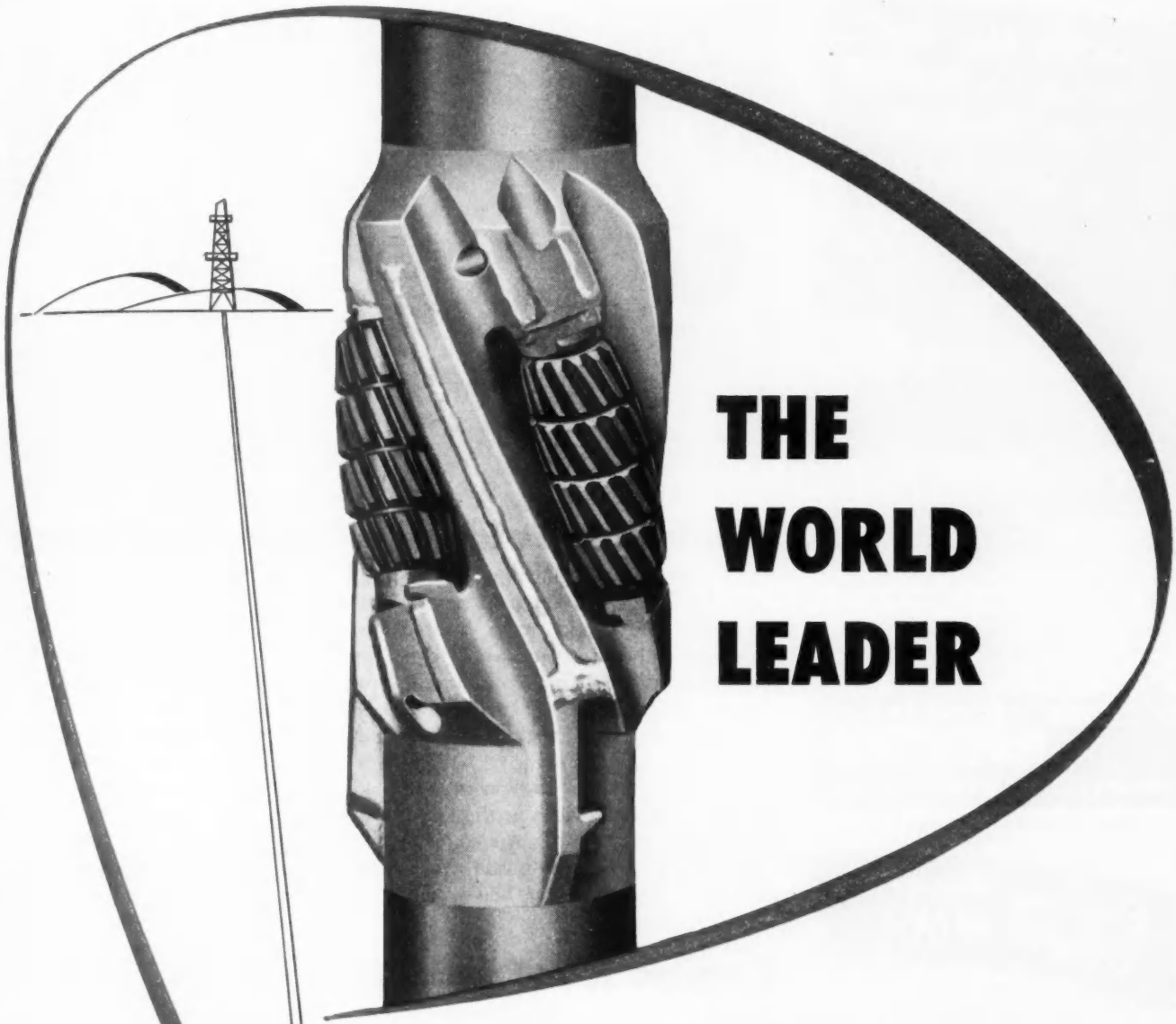

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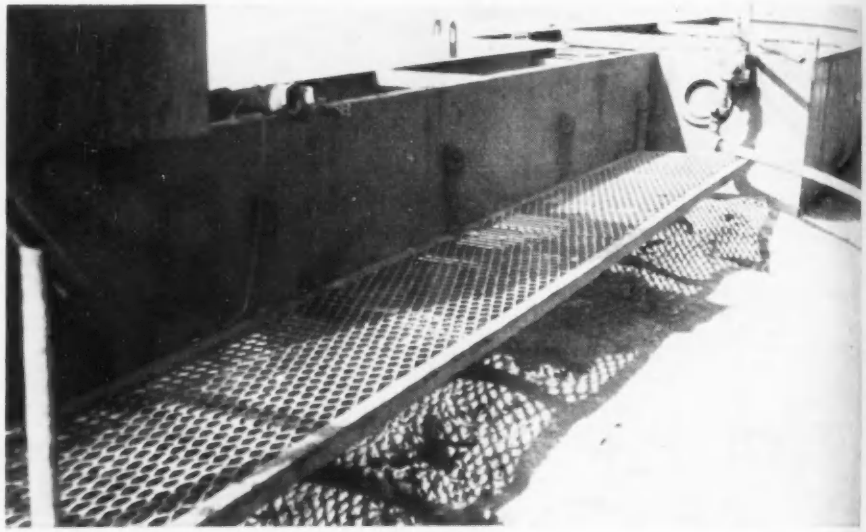
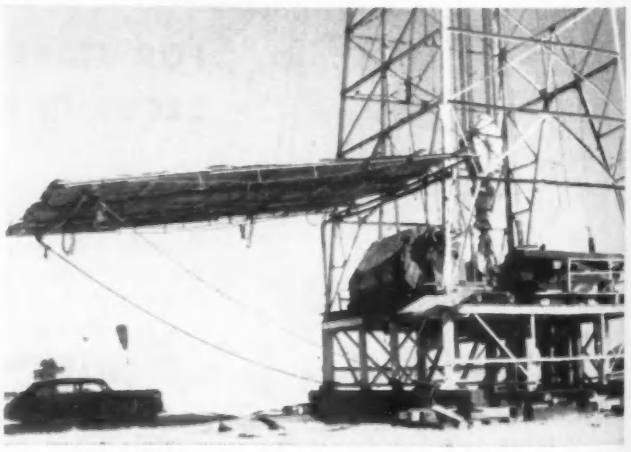


Walkway Folds Up Over Mud Ditch

A method of applying the walk to the side of a mud ditch from the shakers to the suction tank is used which not only saves time when tearing down and rigging up, but the hangers are as substantial as if they were applied each time that the mud system was rigged up.

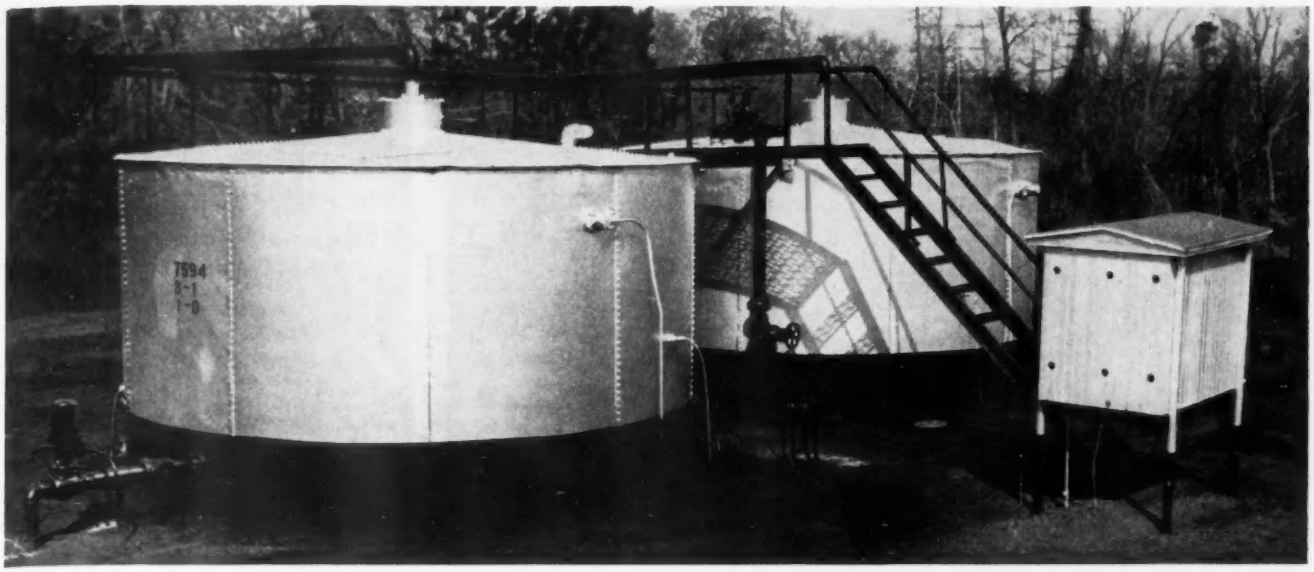
The procedure is to construct a walkway the same width as the ditch, leaving the walk binding, or edges of angle iron to extend over the rim of the ditch. Ninety degree hooks, similar to the fingers of a fork lift, are used upon which the walk is set permanently. The other side of the hooks are hinged to the side of the ditch with clevis-like clips having holes for the pins so the walk can be folded up and over the top of the ditch. At several points opposite the walk, lifting lugs are welded to the side of the ditch, while companion lugs are welded to the outer side of the walk so they may be used when the walk is folded in shipping position.

Engine Roof Is Hinged to Derrick



Primarily to save time, a contractor has arranged fittings and hinges so that the roof of the drilling engine house can be left with the rig when skidding. The roof is built with truss type rafters which ordinarily require no post supports except at the outer ends. At the rig side, hinges are attached to both the roof and the legs of the derrick so that the roof is free to move up and down. When the rig is torn down, the roof is raised at the outer side far enough to permit removal of the engines and substructure.

Guy lines attached to the two outer corners and to the derrick suport the roof in a more or less horizontal position. Snubbing lines attached to these same corners are brought down to the foot of the derrick legs and made fast. Anchored at the top and bottom, the roof is little affected by stiff winds. The roof moves easily with the rig, remains while stored temporarily and is ready to cover the equipment when a new hole is started.



Automatic gauging and transfer battery showing upper and lower float switches, temperature bulb, temperature recorder housing and electrically-operated outlet valve.

After two years of development in East Texas, Shell Oil Company now gauges and transfers oil by a . . .

New Automatic Tank Battery

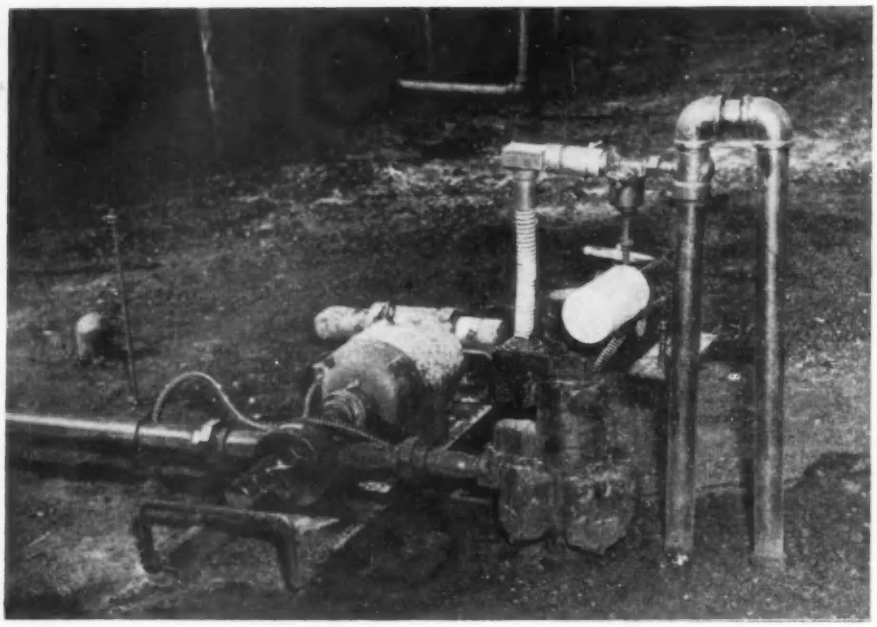
By W. A. MIDDLETON, Shell Oil Company, Kilgore, Texas
and E. B. LAGUKI, Shell Oil Company, Houston

THE FUNDAMENTAL PURPOSE of any automatic control installation is the reduction of operating costs. And considering future development of new fields, the integration of automatic controls and also effect further savings in initial capital investment. The ultimate solution in this respect would probably be the installation of automatic well controls operating in conjunction with several accumulator tanks from which the produced oil could be metered and sold to the pipe line. Along these lines, Shell Oil Company installed an experimental automatic gauging and transfer battery during the latter part of August, 1950, in the East Texas field.

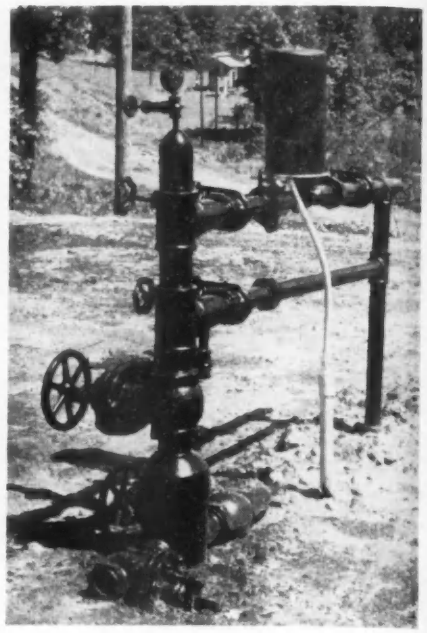
The automatic battery handles four wells which are equipped with automatic flowing controls and transfers the oil to an adjacent battery on the lease from which all the lease production is sold to the pipe line through regular gauging procedures. With reference to the isometric view (Figure 1), the automatic battery components basically consist of an electrical three-way inlet valve (I), high and low level float controls (A and B), electrically operated outlet valves (C), a temperature recorder (M), a transfer pump (P) and a fluid meter and sampler (Q).

The incoming oil from the separator is routed through the three-way valve into either tank 1 or tank 2. After the tank is filled, the high level switch is closed and the three-way valve is actuated through the panelboard to route the oil into the empty tank. The oil in the full tank is allowed to weather for a predetermined time (electrical time delay relay) after which a time delay relay energizes the electric outlet valve, causing it to open. When this valve reaches its "fully-open" position, an electrically-operated transfer pump is energized and pumps the oil via a transfer line to an adjacent battery on the lease. The low level control correspondingly acts as the pump shut down medium. During the course of the fluid transfer process, an electrically-operated routing valve operates in conjunction with the sampling mechanism and allows selective sampling of oil from either tank 1 or tank 2 while the tank is being run. In conjunction with the above, continuous tank temperatures and the length of pumping time are also recorded.

Installation and Design. In designing and installing the automatic battery, due emphasis was placed on the economy of installation as well as the simplicity and dependability of operation. Sufficient safety features have been incorporated to make the system foolproof. Conversion of the standard battery to the automatic installation, exclusive of the time required to lay



Transfer pump assembly showing motor-driven gear pump with a positive displacement meter and selective sampling device.



Typical well installation of an automatically-controlled flowing well in East Texas field.

the transfer line, was completed in one work-week at a cost of approximately $2500.

Primary purpose of this installation was to procure data concerning the consistency and accuracy with which a standard stock tank equipped with automatic controls could fill, top out and empty a constant volume of oil. Three methods of volumetric measurement were employed, and they are as follows:

1. Fluid volume calculated from top and bottom float switch positions.
2. Fluid volume calculated from the pumper's steel line measurement.
3. Fluid volume recorded by a positive displacement oil meter.

Further testing of this battery with the present equipment is continuing and installation of additional features is contemplated to acquire accurate operating data for fuure proposals and/or operating experience for automatic lease operation.

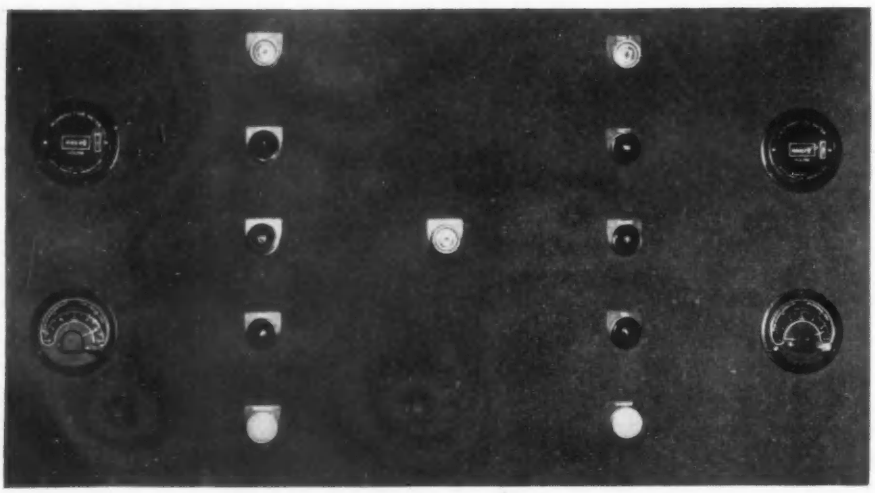
Theory of Operation. The isometric view (Figure 1) of the battery installation will enable the location of various components to be described and the schematic wiring diagram (Figure 2) will permit a better understanding of operational theory.

It will be assumed that the two-tank switcher has been operating normally over a given period of time and for discussion purposes, tank 2 has been drained and is at present empty, while the production has begun to flow into tank 1. With this assumption, the rotary switch is in No. 1 position and the No. 1 filling (amber) light is turned on, since it is connected directly to the rotary switch tap. The three-way inlet valve is not energized and, consequently, the valve port is open to tank 1 and closed to tank 2.

The integral single-pole, double-throw switch attached to the inlet valve is in the normally closed position. Time delay relay No. 1 is in its reset position with switch terminals No. 3 and No. 4 connected and the time delay relay clock is in a non-running position. When the incoming fluid has passed the bottom gauge level in tank 1, the No. 1 float switch (lower float switch) is moved to its normally open position and the empty (green) lamp is turned off. The No. 1 outlet valve will not be energized until the time delay relay has gone through its timing interval.

During the same phase of operation, tank 2 indicates that it is empty (green lamp) and its lower float switch is in the normally closed (NC) position. The No. 2 time delay relay is in its reset position with terminals Y and 3 connected and the time delay relay clock in a non-running position.

Proceeding further, assume that tank 1 has just been filled, and the



Indicating and control panel for automatic gauging and transfer battery.

following operations will occur. After the tank has topped out, No. 1 upper float switch will close, thereby energizing the gear motor which in turn rotates the rotary switch. The switch arm moves from switch position No. 1 to position "R" but, since position "R" is connected in such a way that it continues supplying energy to the gear motor, rotation proceeds until the switch arm touches position "2," where due to the lack of energy, the motor ceases its rotation. When the rotary switch arm passes terminal "R," it also serves the function of momentarily energizing both time delay relay clutches, thereby returning each timer to its normal starting position and closing switch terminals No. 3 and No. 4 in each timer. With the rotary switch in position "2," the three-way inlet valve is now energized and transfers the incoming fluid from tank 1 to tank 2.

The integral SPDT switch on the three-way inlet valve is in its normally open (NO) position and, consequently, energizes one terminal of the No. 1 outlet valve. The full (red) lamp is turned on due to the time delay switch position, and the No. 1 time delay begins to time out its cycle. This weathering period allows the oil production to stabilize and reach an ambient temperature before being run. After the delay interval (six hours) elapses, the switch reverts back to its reset position, i.e., terminals "3" and "Y" are reconnected, the full indicating lamp is turned off, and the outlet valve and draining (white) lamp are energized.

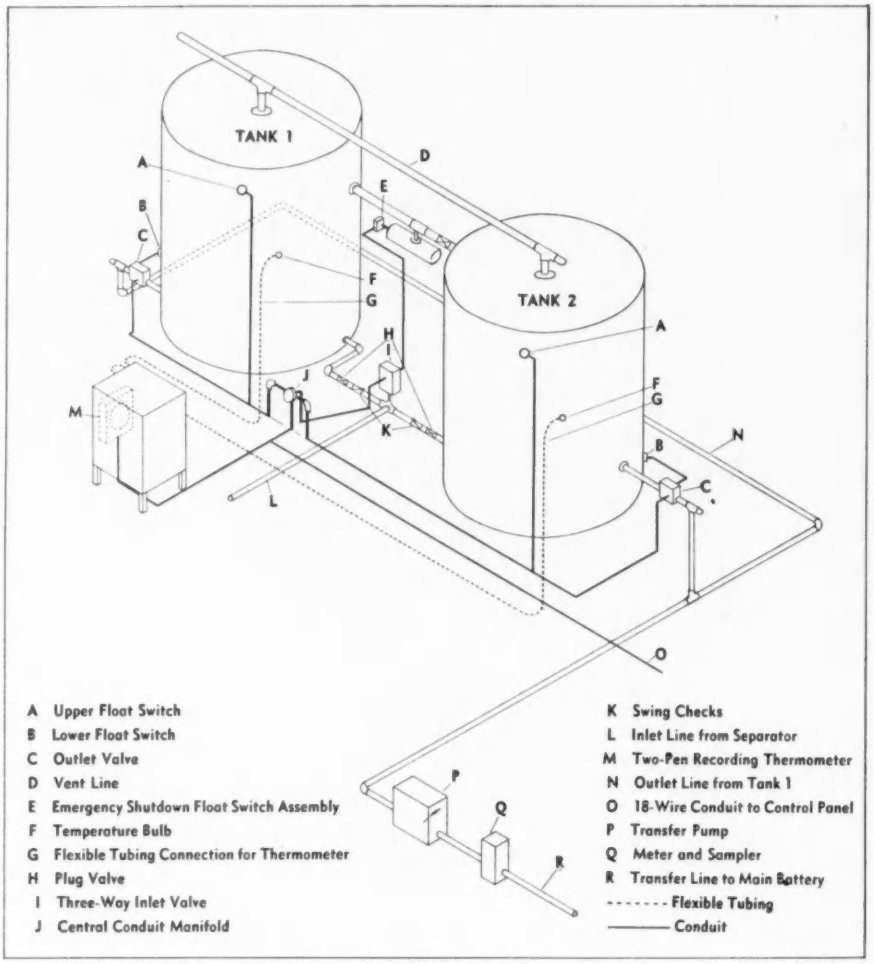


FIGURE 1
Isometric view of automatic gauging and transfer battery.

When No. 1 outlet valve opens, it moves its integrally-connected switch to the normally open (NO) position and energizes the transfer pump motor-holding-coil. After the fluid level drops below the top gauge point. No. 1 upper float switch reopens, and the transfer pump continues operation until the fluid level has reached the No. 1 lower float switch level, at which time the pump motor circuit is broken and the No. 1 empty panel light is again turned on.

Again referring to tank 2 during this same cycle of operation, the filling light indicates that the production is being routed into tank 2 and the lower float switch is in its normally open (NO) position. The time delay relay is in the reset position with the clock non-running and

About the Authors

WILLIS A. MIDDLETON, division mechanical engineer, Shell Oil Company, received his degree in electrical engineering at Georgia Tech in 1948, after having his school work interrupted by service in Navy Air Corps as lieutenant. Joining Shell in 1949 he was assigned to Houston division, Production Department, until transferred to East Texas.

E. B. LAGUCKI, Mechanical Engineer, Division for Shell Oil Company was graduated from Ohio State University in 1949 with a B.S. degree in electrical engineering. During World War II, served in the USAF Communications Section. He was assigned to Shell's East Texas division until May, 1952, then transferred to his present assignment. Shell's Houston division, Production Department.

switch terminals No. 3 and No. 4 are connected together. It will continue to be in this position until tank 2 fills and No. 2 upper float switch closes. When this operational phase occurs, the gear motor is again energized and will rotate the switch across position "R" to position "1," with the occurrence of the same sequence of events that were described above for tank 1. The three-way valve is de-energized and the solenoid-operated pilot valve opens to close the inlet valve to tank 2 and open it to tank 1.

Positive Control. Referring to the circuit diagram, it will be seen that the manual draining switches (key-operated) are connected so as to supply 110 volts to either of the outlet valves, and it is impossible to simultaneously drain and fill either tank with the manual draining switches. The manual switch merely energizes the gear motor to rotate the switch from position "1" to position "2" or vice versa.

Although not mentioned above, the running time meters which are connected in parallel with the individual draining lamps will indicate the time the pump has been on the line. The sampler three-way solenoid-operated routing valve is energized when tank 2 is run, and is de-energized when tank 1 is run, thereby permitting selective sampling of the individual tank runs.

Operational Results. Shell's East Texas Division automatic gauging and transfer battery has been in operation for approximately two years. During this period, there has been sufficient time to experiment with various types of automatic equipment, utilizing only the types which were most suited to the purpose.

A tabulation of recorded experimental data covering the operation of this battery is shown in Table 1.

The data shown as calculated barrels have been determined from the pumper's steel line measurement and were obtained from tank strapping tables. Temperature variations were assumed to be insignificant between sequence of measurements and correction for temperature was not attempted in the tabulation. Computations of percentage error were made with the steel line measurements as a base. The oil meter was calibrated with a "meter-tester" and found to be accurate to the second decimal point.

During the last year of operation, two failures occurred in the lower float switch of tank 1. One failure was due to paraffin accumulation and one failure was due to float linkage misalignment. The adjustments were corrected through routine maintenance which should prevent a recurrence of the failures. Meter readings in error due to pumping air through the meter at the time of these failures are not shown in the tabulation. During this time, tank 2 operated without difficulty and indicates very good operating accuracy.

Initial Aims. Although the fully automatic gauging and transfer battery is presently in its so-called embryonic stage, many of the initial aims have been achieved. Under the present design conditions, this equipment can automatically fill and top out a tank; provide a preset time delay before running the oil; record a 24-hour temperature of each tank; take a sample during each run and automatically record the number of barrels which have been transferred to an adjacent battery. However, many improvements can be made in

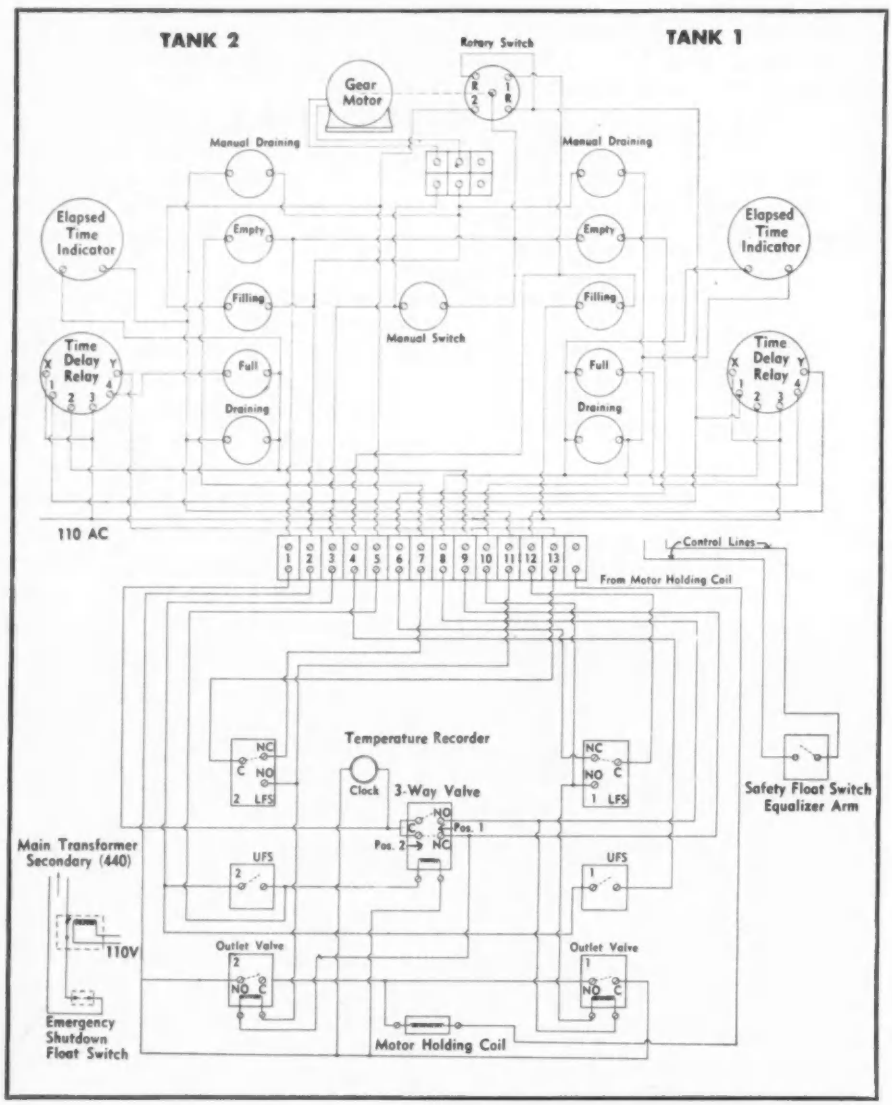


FIGURE 2
Wiring diagram for controls of two-tank switcher for automatic gauging and transfer battery.

TABLE 1
Experimental Data
Period Covering 1-1-51 to 10-1-52

Tank No.	No. of Tank Runs	Calculated Barrels	Oil Meter Barrels	Difference Bbls.	Percent Error
1	92	12,741.2	12,735.2	—6.0	0.047
2	103	15,482.7	15,489.4	+6.7	0.043
	195	28,223.9	28,224.6	+0.7	0.002

■ CONTINUED ON PAGE 204

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LS-15

Mud-Stuck Tubing Recovered By String-Shot Backoff Method

Accurate strain gauges and the string-shot make possible economic operation during workover.

By FLOYD SCOTT, JR.

The Dia-Log Company, Houston

A NEW TECHNIQUE employing the string-shot backoff procedure has been perfected for recovering strings of mud-stuck tubing. This method employs the principle of removing a portion of the heavy mud from the annular space around the tubing so that the pipe can be released at greater depths. The method involved is to locate the deepest free point, back off the tubing at this point, remove the heavy mud by circulation without removing the backed-off tubing from the hole. The string is then screwed together again and the free point, back off, circulation procedure is repeated.

In this phase of the backoff procedure, the deepest free point in the tubing string is first located and a backoff is made in the usual manner. Instead of withdrawing the tubing from the hole, this new method merely employs establishing circulation through the portion of the tubing string that has been backed off. Next step in the procedure is to screw the tubing back together and rerun a free point indicator to establish the new free point. A backoff at the newly established free point is then made, followed by circulation without removing the tubing string from the hole. This procedure is repeated as many times as is necessary to recover the tubing string as well as the production packer. Considerable saving in time and expense is realized. In some instances as much as ⅔ of the cost of recovering tubing by conventional fishing methods has been saved in this manner.

It was difficult to visualize the fact that drilling muds could set up and cause the tubing above the production packer to become completely immovable. In the recent past, however, this fact has been proved beyond any reasonable doubt. Possibly the first recognition of the phenomena of mud stuck tubing was made in the Fannett field of Southeast Texas. During work-over operations on one of the wells in this field, the tubing could not be worked loose. It was surmised that possibly the drilling mud used at the time of completion had "setup" and was sticking the tubing.

Following this reasoning a new technique was tried. A single shot tubing perforator was lowered inside the tubing and a hole was punched about halfway down the string. A high-pressure pumping unit was then established. Several other shots higher in the string yielded no improvement until a perforation at a considerably shallower depth was made. Circulation was established through this hole and maintained for a sufficient length of time to wash out the congealed mud in the annulus. Plugging this hole allowed pressure to be applied farther down the tubing where a previous perforation permitted circulation.

By carefully spacing the shots and by using relatively high pressures to break circulation the entire annular space between the tubing and casing was cleaned of congealed mud. It was found that the packer was entirely free and could be removed without difficulty once the annulus was cleaned out.

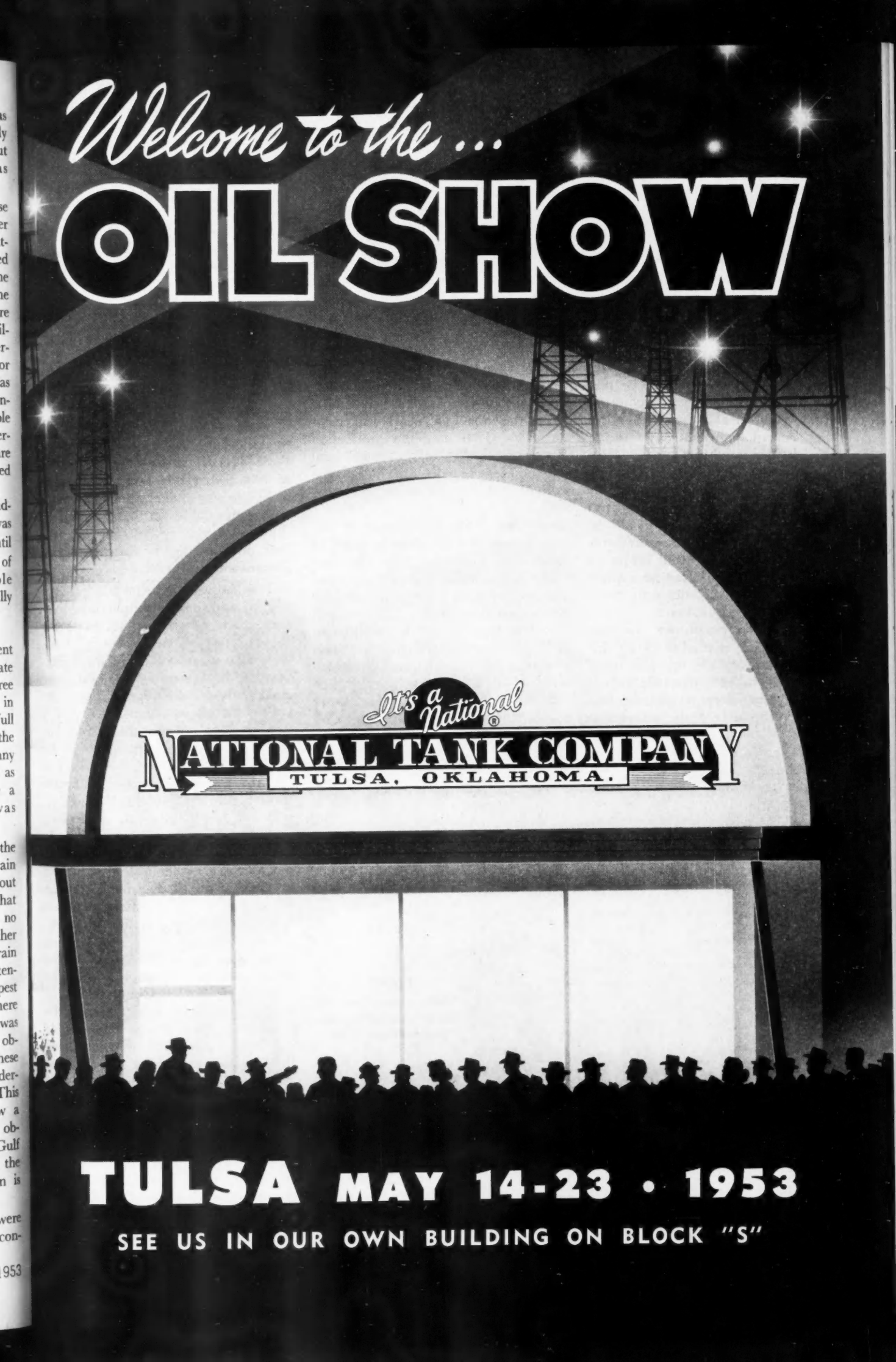
The procedure followed in this case was a substantial improvement over previous methods, but subsequent attempts to do the same thing revealed some weaknesses in the process. In the first place, the positioning of the original perforation involved pure guesswork. In addition to the possibility of guessing wrong on the first perforation, there was the added factor that the tubing thus perforated was entirely unusable. Another disadvantage was the possibility of being unable to plug satisfactorily the initial perforations so that sufficient pressure could be applied at lower perforated holes in the tubing.

Although the problem of mud-stuck tubing was recognized, it was not clearly mechanically defined until the present time. Because of lack of definition, there was considerable doubt that the problem actually existed as it was visualized.

New Method. With the development of a highly sensitive and accurate strain gauge capable of a fine degree of quantitative strain measurement in both torsion and tension came a full recognition and evaluation of the problem. As in the case of many similar types of problems, as soon as the situation was entirely visible a perfectly apparent solution was available.

In the work of determining the deepest free point with this strain gauge in strings of tubing throughout the Gulf Coast, it was found that many stuck tubing strings had no definite "sticking point," but rather showed a "sticking zone." As strain measurements in both torsion and tension were made between the deepest entirely free point and the point where no movement was recorded, it was found that a definite pattern was obtained in nearly every one of these cases. This pattern can best be understood by reference to Figure 1. This graph has been plotted to show a typical case from average data obtained in many wells in the Gulf Coast area. Actual movement of the pipe in both tension and torsion is illustrated.

These strain measurements were made at each depth by applying con-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stant loads in tension and torsion. It can be seen that the normal "free" strain due to torsion and tension occurs as a straight vertical line. As the sticking zone is entered strain readings of decreasing amounts are obtained until a point is reached where no movement is possible. The deepest point where normal torsion and tension strain measurements are obtained is classified as the "free point." Emphasis is placed in all cases on the behavior of the torsional strain measurements. It can be seen from Figure 1 that a backoff would not be possible below the depth marked, "free point" because it would not be possible to impose a sufficient amount of torque to effect a backoff below this point. An anomaly that is frequently found is illustrated in Figure 1. Here tension strain measurements would have been misleading, showing the pipe to be free far below the depth where a successful backoff could be made. Torsion strain measurements show clearly that sufficient torque to make a backoff could not be applied at the "free" depth determined by tension strain measurements.

After having established the fact that the tubing is mud-stuck by this typical behavior, the operator then knows that he can part the tubing string at the deepest entirely free point by the use of the string-shot backoff technique. Having thus parted the tubing string, circulation can be established to flush the heavy mud above the backoff point. This is done without removing the pipe from the hole.

After circulation has completely removed the heavy mud from the casing annulus, the pipe is screwed together and a new free point determination is made. In all cases the new free point will be found several hundred feet below the initial free point, and a second backoff is made at the newly established free point. The procedure is then carried on as in the first case and is repeated as often as is necessary without ever removing the tubing from the hole. In nearly all cases encountered to date the production packer is not fouled or "stuck" and can be easily removed after the pipe is freed from its mud-stuck condition.

First Use. First application of this new technique was made in the Ged field near Lafayette, La. The free point indicator readings in torsion and tension indicated the typical behavior as illustrated in Figure 1. It was felt that the pipe should be withdrawn from the hole to thoroughly condition the mud above the backoff point. Instead of screwing back into the pipe remaining in the hole, a "rotary socket" or "overshot" was used to reconnect the "fish" and the tubing string.

In this case the initial free point was located at 1597 feet and a successful backoff was completed at this depth. The string of pipe was removed from the hole without circulating. Circulation was established after the pipe was run back in the hole with the overshot on the bottom joint. Circulation continued for several hours, during which time gelled mud was replaced with a lighter mud of lower viscosity. A subsequent free point determination found the pipe to be entirely free at 2025 feet. A successful backoff was accomplished here and the procedure was repeated, using the overshot to join the string back together. The last backoff took place three days from the start of the job at 4000 feet. Production packer set at 5200 feet was pulled after circulation had been established to 4000 feet. In this case the packer was entirely free and the only reason for the fishing job was the mud-stuck tubing above it.

This job was performed in January of 1952 and since that time there have been many others leading up to the present stage of development of the technique as evidenced in the Willamar field of southwest Texas near Raymondville. Attempts to pull the packer in this well had failed and it was decided to use the string-shot backoff technique to recover the tubing and packer from the hole. The first run with the free point indicator showed clearly a mud-stuck condition, with the free point being established at 3005 feet. The pipe was entirely stuck, showing absolutely no sign of movement in either torque or stretch at 5990 feet. A backoff with the string-shot was successfully made at 2995 feet. After completing the backoff, the pump unit of a cementing truck was connected to the tubing string and an attempt was made to establish circulation. Circulation could not be established at this depth by the cementing truck pump. Five double stands of tubing were removed from the hole before another attempt was made to break circulation.

Before the third attempt to establish circulation was made, five additional double stands were removed. At 1900 pounds pressure, circulation was established, dropping to 300 pounds after 45 minutes. The ten stands of pipe pulled to establish circulation were run back in the hole and

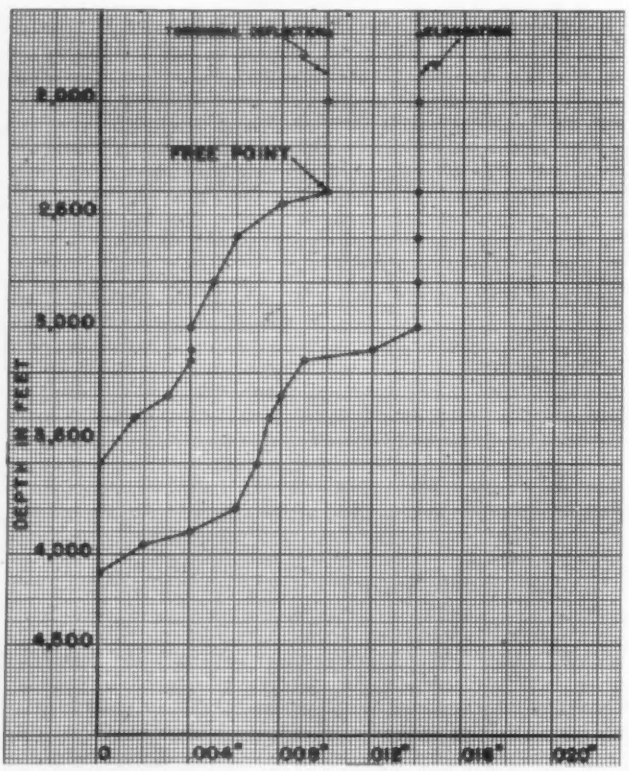

FIGURE 1
Torsional deflection and elongation of tubing measured in 52-inch length.

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LOOK FOR THE GREEN RODS

circulation was re-established after each stand. When the top of the fish was reached, circulation was maintained for about an hour. The tubing string was reconnected without difficulty and a second free point determination was made. The deepest free point this time was established at 5002 feet and the tubing was backed off at this depth. After this backoff ten stands of pipe were removed before any attempt was made to break circulation. Circulation was established at 2000 pounds pressure, which dropped to 350 psi after 30 minutes.

A third free-point and backoff was made at 7743 feet and mud was conditioned as before. When the company screwed back into the tubing for the third time they were able to pull the packer which was set at 7890 feet. As in the first case, the packer was entirely free and was pulled without difficulty after heavy mud in the annular space above it had been cleaned. This job was completed in 13 hours of operating time with an additional 19 hours of circulation before the packer was removed from the hole.

It must be remembered in all cases that the success of the technique is entirely dependent upon the correct interpretation of the strain gauge measurements and making a backoff at the deepest entirely free point each time.

Several oil companies operating in high pressure areas necessitating the use of heavy muds at completion have reported a saving of nearly ⅔ of the cost of tubing recovery over conventional methods previously employed. The primary factor in such a tremendous saving in workover cost is the rapidity with which the job can be accomplished. This, together with the fact that lighter workover rigs can be employed than normally could be used in conventional fishing jobs, makes such a saving entirely understandable.

In all cases so far encountered the recovered tubing has been in good condition and there has been no damage to any of the threaded connections or lengths of pipe resulting from using the string-shot in this class of work.

The physical limitations of screwing back into the tubing seem to be very few. Apparently the circulating procedure does not destroy the heavy mud structure around the top of the "fish" and realigning the threads in the pipe for engagement is not difficult because of this fact. In any event, all of the work done so far has shown that no difficulty was encountered in screwing back into the fish and that no threads have been damaged by this practice. Evidence of this fact lies in the pressures used to establish circulation after several backoffs have been made and the pipe has been screwed back together several times. If thread damage had resulted, the connections would not be able to withstand the pressures that are necessary to establish circulation in the viscous mud columns surrounding the tubing. Careful examinations of the connections that have been backed off show them to be perfectly usable after the pipe is removed from the hole.

About the Author

FLOYD SCOTT, JR., received his bachelor's degree in mechanical engineering in 1940 from Rice Institute, Houston. He completed his freshman year at Texas A. & M. College in 1934. During his undergraduate years, beginning in 1936, he worked with Brown Oil Tools, Inc., Houston, during summers and weekends. In 1938 Scott was placed in charge of Brown Oil Tool's drafting room, and in 1942, he was made chief engineer. In this position he was responsible for the design and construction of many fishing tools and oil field equipment, and holds patents on several tools. In 1948 he was made sales manager of Brown Oil Tools, Inc., which position he held until May, 1951, when he joined The Dia-Log Company at Houston as sales engineer.

Automatic Tank Battery

• CONTINUED FROM PAGE 198

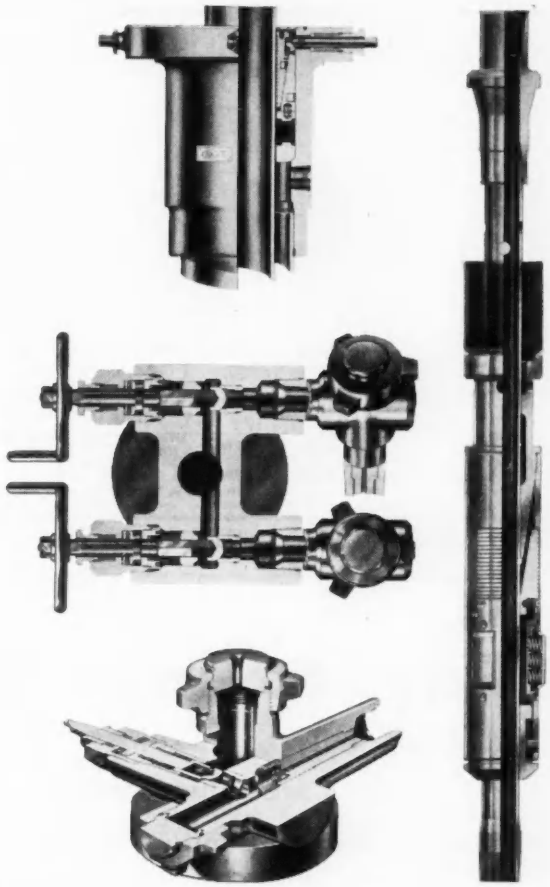
an attempt to make this type of installation acceptable to the pipe line companies on a general basis instead of a particular lease or field. Principal among these improvements, which are lacking in our present installation, are the following:

- A means of recording the approximate time at which each tank is run.
- A method for continuously recording the API gravity and water cut of an oil run.
- A device for shutting-in the entire system should the water cut exceed a predetermined minimum.

Continued operation of the experimental automatic gauging and transfer battery is planned and, at present, the installation or development of sufficient equipment to make up the deficiencies outlined above is being contemplated.

Since its installation, the control mechanism has functioned without any major failure for approximately 195 tank runs. Consequently, results indicate that presently-installed equipment is rugged enough to withstand field usage. Future experimentation will be directed toward maintenance of reliable volumetric measurement, compilation of operating data and proper maintenance schedule as well as gravity and BS&W measurement.

Savings Substantial. The monetary savings, both labor and capital, to be realized from a general field installation of automatic gauging and transfer batteries in a new field are numerous. In a new field, automatic well controls could be employed in conjunction with numerous strategically located automatic batteries, feeding a central gathering and storage system. By eliminating the need for numerous 500 and 1000 barrel stock tanks, which would otherwise be required, operators could effect a tremendous capital investment saving. Needless to say, the attendant labor required for a completely automatic lease would be reduced; and, it has been found that the average pumper could perform his new duties with more emphasis on technical aspects which are inherent in the maintenance and operation of a fully automatic lease.



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Each one of these new O-C-T products was designed to improve production equipment performance and safety . . . and industry acceptance has proved the need.

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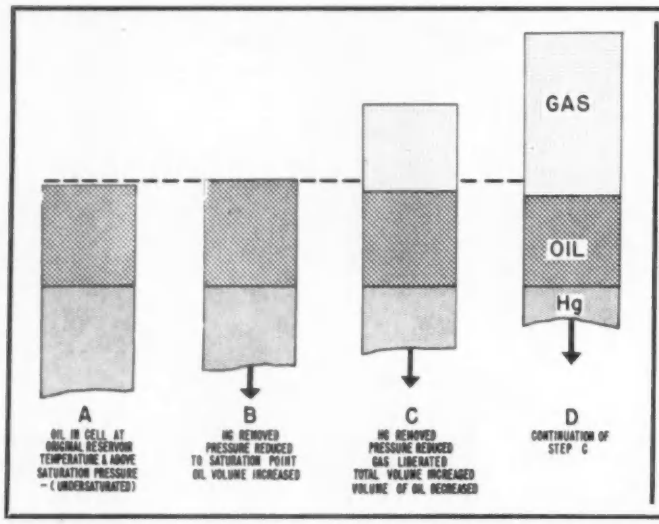
GAS
OIL
Hg
A
OIL IN CELL AT ORIGINAL RESERVOIR TEMPERATURE & ABOVE SATURATION PRESSURE – (UNDERSATURATED)
B
HG REMOVED PRESSURE REDUCED TO SATURATION POINT OIL VOLUME INCREASED
C
HG REMOVED PRESSURE REDUCED GAS LIBERATED TOTAL VOLUME INCREASED VOLUME OF OIL DECREASED
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FIGURE 12. Laboratory equilibrium liberation (P-V-T) of gas from oil.

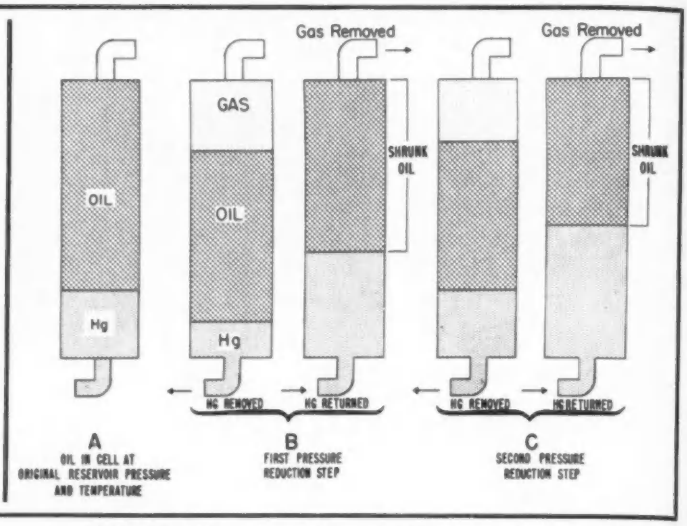

FIGURE 13. Laboratory differential liberation of gas from oil.

It Pays to Know Your Petroleum

Here are other factors that must be considered in optimum production of a given reservoir. A discussion of sampling and testing, gas liberation, and retrograde condensation.

By NORMAN J. CLARK
Humble Oil & Refining Company, Houston

Testing of Fluid Properties and Behavior. As pressure is reduced in the reservoir, and liquid and gas phases are formed, one or the other of the two phases is produced differentially to some degree because of variations of permeability of the rock to gas and oil as saturations change. Hydrocarbon analysis of the composite production, therefore, changes from that of the original material in place in the reservoir. Thus, the behavior of reservoir fluids during production operations cannot be described completely by what their behavior would be under equilibrium conditions. It is necessary to obtain laboratory measurements on phase behavior of reservoir fluid samples for conditions of change where liquid and gas separate both differentially and under equilibrium conditions so that production problems involving separation under both conditions may then be solved.

Where the production problem deals with changes in the reservoir material under conditions approximating that of equilibrium conditions, such changes may be calculated with reasonable precision. For this purpose the concept of K-values has been employed. A K-value is the ratio of the mol fraction of a compound in the gas phase and the mol fraction of the same component in the liquid phase. In essence, it is a measure of the volatility which is controlled by the balance between the molecular forces at the condition of temperature and pressure at which the material exists. These equilibrium calculations should be supported by laboratory data.

The practical approach to the study of reservoir fluid behavior as practiced by the industry is to anticipate pressure and temperature changes to which the reservoir material will be subjected in the reservoir and at the surface during production operations and then measure the changes occurring to reservoir fluid samples by laboratory tests for these pressure and temperature changes.

Part 2

Oil Reserves

Sampling and Testing. There are two general methods for obtaining a sample of reservoir oil for laboratory examination purposes. They are (1) by means of subsurface samplers[7,8] and (2) by obtaining surface samples of separator liquid and gas. Separator samples of oil and gas are recombined in the laboratory in proportions equivalent to the gas-oil ratio measured at the separator.

Data usually obtained are (1) original reservoir temperature and pressure; (2) pressure-volume relations at one or more temperatures, one of which is always measured at reservoir temperature, taken in a manner as shown in Figure 12; (3) effects of variation of surface separator pressure on amounts of gas liberated and shrinkage of oil resulting from such separation process; (4) differential gas liberation and oil shrinkage data, taken in a manner as shown in Figure 13; (5) density or specific volume of reservoir fluid; (6)

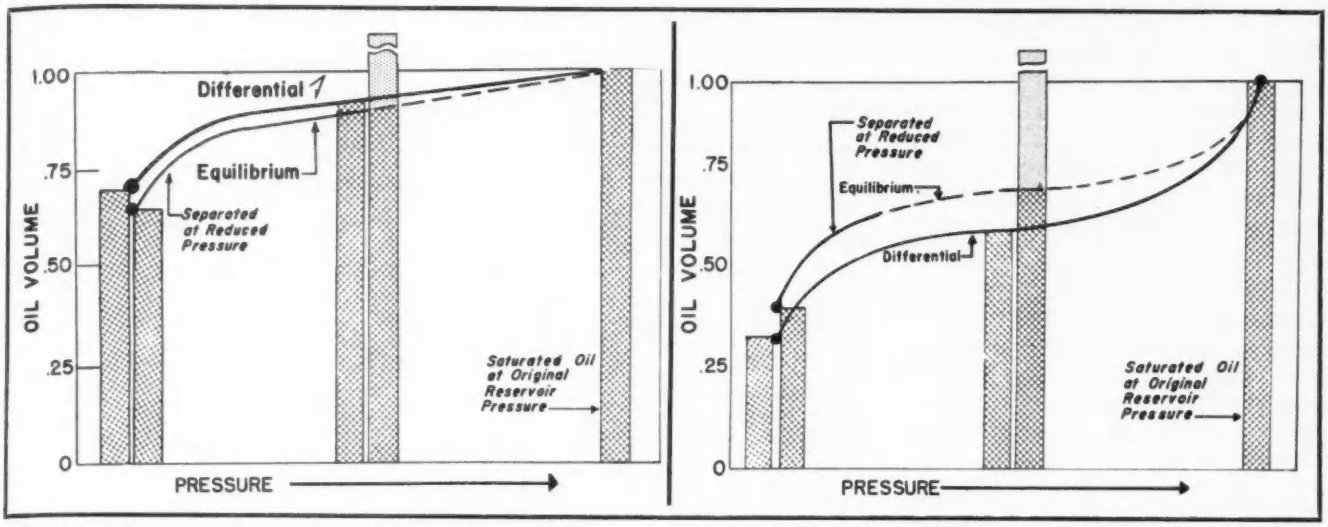

FIGURE 14. Differential and equilibrium shrinkage of low shrinkage oil.

FIGURE 15. Differential and equilibrium shrinkage of high shrinkage oil.

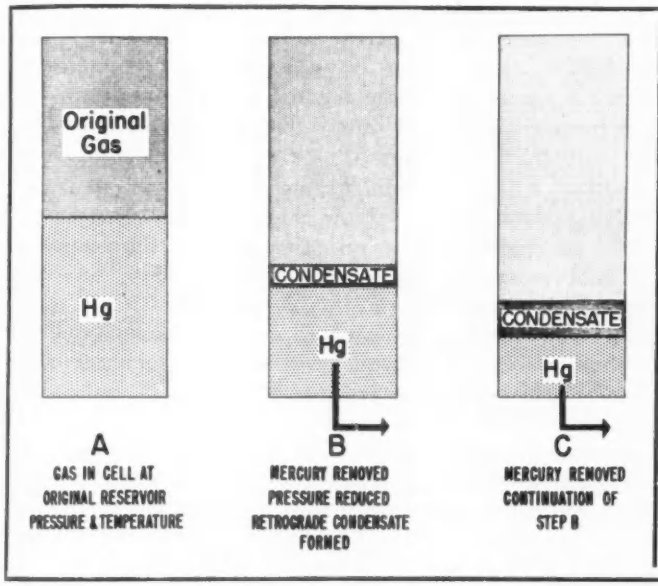

FIGURE 16. Equilibrium retrograde condensation of liquid from gas.

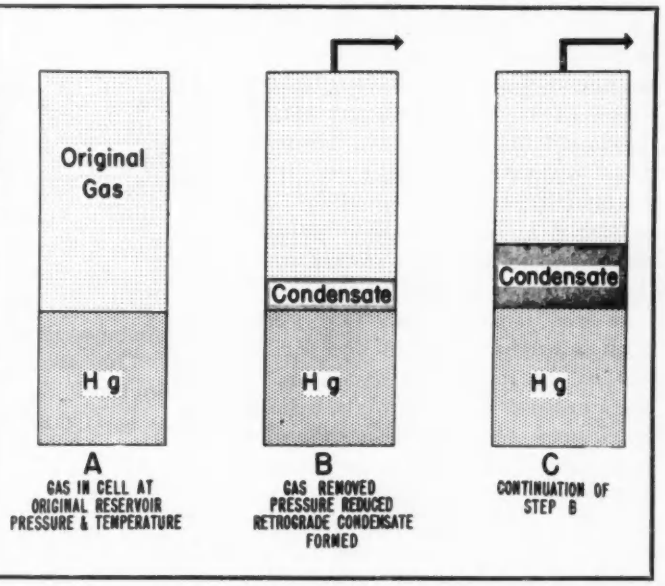

FIGURE 17. Differential retrograde condensation of liquid from gas.

viscosity relation of reservoir oil at reservoir temperature and at pressures ranging from reservoir pressure to atmospheric pressure and the viscosity of stock tank oil; (7) hydrocarbon and orsat analyses of the mixture as it existed originally in the reservoir; and (8) ASTM distillation analyses of residual oil.

Equilibrium and Differential Data. If liberated gas is permitted to stay in direct contact with a liquid sample (Figure 12), a different volume of gas will be liberated down to a given pressure than would be liberated if the gas were removed from contact with the liquid as it is liberated. The remaining liquid is likewise different in the opposite direction and thus shrinkage is different. Differential liberation is that process of gas liberation where the gas is removed as it is formed incident to a drop in pressure at constant temperature (Figure 13). Each type of liberation process is at one time or another encountered to a certain degree in the production of petroleum deposits and therefore both processes for a given oil sample must be investigated to provide data for any eventual reservoir study.

A comparison of equilibrium and differential shrinkage of a low shrinkage oil under reservoir conditions as pressure drops is presented by Figure 14. This shows that under equilibrium conditions a greater quantity of heavy components are progressively pulled into the gas by the light gas components, and thus oil shrinkage is greater. The low shrinkage by differential liberation under these conditions is caused by gas being removed as it is formed, thus preventing attraction of light gas molecules to heavy liquid molecules and minimizing the quantity of liquid pulled into the gas phase.

A comparison of equilibrium and differential shrinkage of a high shrinkage oil is presented in Figure 15. In this case, the difference is reversed from that of low shrinkage oil. A relatively greater quantity of gas is formed in the high pressure range than is formed with low shrinkage oil. This is caused by a large quantity of intermediates being pulled into the gas phase because of a great attraction to the light gas molecules which are densely spaced at the high pressure condition, and because of high kinetic energy of the intermediates. Once the large quantity of intermediates is removed from

the system by differential liberation, they have no further influence on gas liberation and oil shrinkage and therefore oil shrinkage remains high through lower pressure ranges. If the gas is not removed, as in flash liberation, some intermediate gas molecules condense because their attraction to the light gas molecules is reduced as pressure drops and the light gas molecules separate further and thus the vaporizing tendency of the high shrinkage oil is reversed to the degree that shrinkage is less under equilibrium conditions than under the differential process.

The shrinkage curves of both the low and high shrinkage oil illustrate that near atmospheric temperature and low pressure conditions, shrinkage of oil greatly increases and presents a problem if a maximum amount of the material is to be produced to the stock tank as saleable liquid. Oil of all degrees of shrinkage will shrink less to the stock tank if the material is first passed to a separator at some elevated pressure and the free gas that is formed up to that pressure and temperature is separated. If the pressure is very low, a large amount of shrinkage will occur to the oil before separation. If the pressure is very high a large amount of shrinkage will occur after separation. Thus there is an optimum separator pressure condition where minimum shrinkage of the oil is obtained. Separation therefore is to a degree a differential process of gas liberation. Stock tank shrinkage may be minimized economically on normally high shrinkage oils only by two or more stages of separation prior to production of the oil to the stock tank. A greater degree of differential liberation is thus maintained. The economic justification for operation under optimum conditions may be somewhat reduced if the separated gas is delivered to a gasoline plant where the remaining liquefiable hydrocarbons will be recovered.

Gas Reserves

Sampling and Testing. Gas reserves may be considered in three classifications: (1) dissolved, (2) associated, and (3) nonassociated. Dissolved gas reserves are those which are in place in the reservoir dissolved in oil and will be liberated with drop in pressure incident to oil production. Associated gas reserves are those in place in the reservoirs as caps of gas above and in equilibrium with oil zones. Non-associated gas reserves are those which are in place in reservoirs as free gas deposits not adjacent to or in equilibrium with oil deposits.

There are three general types[9] of free gas classified according to their phase behavior upon reduction of temperature, pressure, or both as illustrated by the phase diagrams of Figures 9, 10, and 11. The types are termed retrograde gas condensate, wet gas and dry gas, respectively, and may apply to either associated or nonassociated gas deposits.

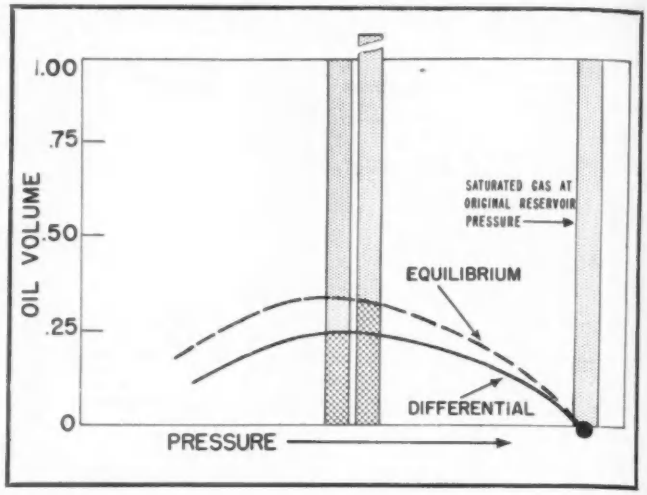

FIGURE 18. Differential and equilibrium condensation of liquid from retrograde gas.

There are two general methods for sampling gas wells.[10] The first method utilizes the full-scale field separator and involves recombination of separator material in the laboratory for testing. The second method utilizes a tubinghead or line probe which diverts a portion of produced material to a mobile small scale separator, portable laboratory, or test car which involves performing a portion of the tests in the field on large samples. Most use of the latter method is limited to detailed testing of retrograde gas condensate reservoirs.

Information concerning the characteristics and behavior of gas most frequently needed for reservoir studies depends upon the types of gas being considered and the nature of the problem. If the problem at hand involves retrograde condensation as pressure drops, the information needed may become very complex requiring numerous tests and measurements. If the problem involves wet gas where no retrograde condensation occurs, but liquid is recovered in separators, or if the problem involves dry gas where no liquid is condensed in either the reservoir or separator, then the information needed may be considerably less complex. Retrograde gas condensate material will be described here. It is of importance that enough tests be made on gas produced from wet gas reservoirs to positively identify the gas as not being a retrograde material in order not to lose substantial amounts of liquid that could otherwise have been recovered economically.

Laboratory data of gas condensate reservoir fluids include data on (1) the quantity, hydrocarbon analysis, and specific volume of original material in the reservoir, (2) the quantities of vapor and condensed liquid in the reservoir at subsequent reduced reservoir pressures, and (3) the complete surface separation history as reservoir pressure decreases, which include optimum separation data together with hydrocarbon analyses of separator gas, separator liquid, stock tank gas and stock tank liquid.

Equilibrium and Differential Data. If pressure is dropped on a gas sample by increasing the volume without withdrawing gas, a different volume of liquid will drop out by retrograde condensation than will occur if the pressure is dropped by removing gas without changing the volume of the remainder of the sample. The first process, illustrated by Figure 16, is termed equilibrium condensation. The latter process, illustrated in Figure 17, is termed differential condensation and is analogous to production from a closed reservoir.

A comparison of equilibrium and differential condensation of a retrograde gas as measured in the laboratory is presented in Figure 18. More liquid condenses under equilibrium conditions than under differential conditions because a greater quantity of gas remains in the system in the

equilibrium process from which heavy components may condense as pressure drops.

Gas Condensate Problems

The problem in gas condensate reservoir material lies in the change of composition of produced material brought about by the retrograde condensation in the reservoir of the heavier hydrocarbon components as reservoir pressure drops. Retrograde condensation drastically affects desirable operations because it is the condensate material that provides a portion of the income from the produced gas or conversely would provide the loss of income if allowed to condense in the reservoir to form a liquid saturation. Because this liquid saturation is small on a basis of percent of pore volume of the entire reservoir, displacement of it from most areas of the reservoir other than adjacent to the well bore may not be accomplished mechanically by production of the reservoir gas.

The reservoir may be produced by pressure depletion or by cycling operation, or if water influx occurs it may be produced by water drive. In straight pressure depletion operations, the retrograde liquids may be lost to a large extent. In cycling operations, the dry gas is returned to the reservoir to displace the condensate gas from the reservoir and to maintain reservoir pressure at some high value and eliminate some of the retrograde loss. Cycling may be carried out at any one or a combination of changing reservoir pressures during the producing life of the reservoir. The desirable operation to employ depends principally upon overall economics and involves displacement studies. In making studies of condensate reservoirs, it is necessary to know the quantity and quality of the material recoverable under both types of operations.

The problem of surface separation is involved in the production of gas, just as it is in the case of oil production, whether reservoir conditions at the time of production are at original pressure or at some reduced pressure. It is necessary, therefore, to establish proper separation conditions if a maximum amount of liquids is to be recovered in the separator.

Laboratory data support discussion

EDITOR'S NOTE: To support the author's discussion on comparisons of liquid shrinkage through flash and differential liberation for different types of reservoir fluids, J. C. Allen, The Texas Company, Producing Department, Research Laboratories at Bellaire, Texas, offered the following laboratory data.

The variety and complexity of known reservoir fluids have increased markedly in recent years. Reservoirs have been discovered that contain hydrocarbon mixtures that exhibit "abnormal" behavior as compared to the majority of "black oils." These fluids have increased the need for a better understanding, first, of their behavior as measured in the laboratory, and second, of prime importance, of how the measured laboratory behavior can be utilized for increased recoveries in the field. The author has done an excellent job in relating laboratory measurements to full scale field application.

At The Texas Company laboratories measurements have been made for several years on both flash and differential liberations at reservoir temperature upon a wide variety of reservoir fluids, including gas condensates. Figure A shows a comparison of these two types of liberation procedures for three fluids. Reservoir Fluid A shows the lowest shrinkage, and it is noted that by flash liberation a greater shrinkage of the oil results than by differential. For the highly volatile, high shrinkage, Fluid B, the opposite effect is found. Between 15 and 300 pounds per square inch absolute, the data from separator flashes at atmospheric temperature are included.

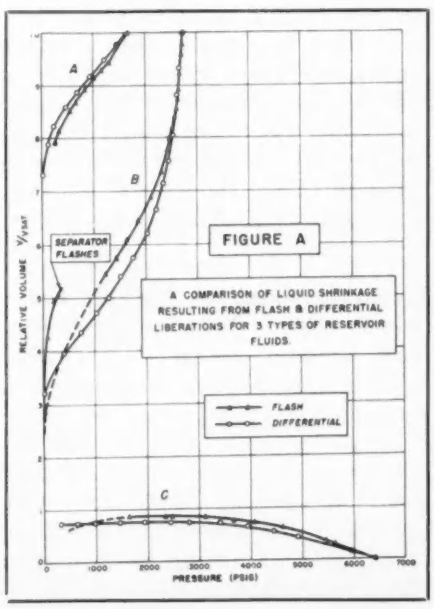

FIGURE A

A COMPARISON OF LIQUID SHRINKAGE RESULTING FROM FLASH & DIFFERENTIAL LIBERATIONS FOR 3 TYPES OF RESERVOIR FLUIDS.

The atmospheric flash is below the differential terminus, thus, it follows that flashing to atmosphere at reservoir temperature would result in even greater shrinkage. Although the flash data do not extend below 1200 pounds per square inch, this curve would probably cross the differential curve at some lower pressure. The separator flash curve could not be joined smoothly with the flash curve at reservoir temperature. This observation affords one with the magnitude of error that would be introduced by constructing a line from the highest separator flash to the bubble point in lieu of data in between. Reservoir Fluid C is a gas condensate and the relation between flash and differential results are compared qualitatively to the highly volatile Oil B. There again the flash curve would probably cross the differential at the lower pressures. This condition has been observed for other gas condensate systems.

The following table lists gas-oil ratios and stock tank liquid gravities for the three fluids:

Reservoir Fluid	Gravity (°API)	Gas-Oil Ratio
A	41.5	810
B	53.2	3,169
C	47.4	17,228

This data certainly confirm the author's concepts relating to the two types of liberation procedures.

ACKNOWLEDGMENT

This article was based on a talk given by the author at the Dec. 9, 1952, meeting of the Houston Chapter of the API, which gave permission for publication here.

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(Second of Two Parts)

Boron Compounds Used As Water-Flood Tracers

Borax and boric acid compounds ideal for checking channeling to nearby producing wells.

By P. G. CARPENTER, T. D. MORGAN and E. D. PARSONS
Phillips Petroleum Company, Bartlesville, Okla.

BORON COMPOUNDS can be used successfully as tracers to detect channeling or bypassing of water injected into underground reservoirs, according to field experiments conducted in Greenwood County, Kansas, and Osage County, Oklahoma.

A good tracer material should—

- Be susceptible to quantitative determination at very low concentrations.
- Either be entirely absent or else present only in trace quantities in natural waters.
- Not react with the input or connate waters to form a precipitate.
- Not be absorbed by reservoir rocks.
- Be reasonably water-soluble so that the required concentrations may be introduced at input wells.
- Be cheap and readily available.

These requirements are almost completely satisfied by the element boron in the forms of borax and boric acid.

For practical field application, analytical procedures have been devised by which very small concentrations of boron (a few parts per million) in flood water can be detected and measured. Water samples from producing wells were analyzed for boron by two methods: (a) by fluorescence analysis which is very rapid and can be done in the field and (b) by the emission spectrograph.

The fluorescence analysis is quite simple: (1) "boron reagent" is added to the sample; (2) the fluorescence of the resulting solution is measured with a Klett Fluorimeter[1] and converted to "parts per million boron" by reference to a calibration curve. The boron reagent was prepared by dissolving 25.0 grams sulfosalicylic acid in 500 milliliters of concentrated sulfuric acid; 60 ml of this stock solution was then diluted with 2420 ml of concentrated sulfuric acid. Boron forms a highly fluorescent addition compound with this reagent.

It should be pointed out that the fluorescence analysis gives a positive indication of the absence and not of the presence of boron, the reason being that other fluorescent substances may be found on rare occasions in the samples. Therefore, all samples should be screened for boron by fluorescence analysis, and those showing boron returned to the laboratory for spectrographic confirmation. The emission spectrograph gives positive identification of boron, although the analysis is more time consuming and must be conducted in the laboratory.

By the spectrographic method 25 to 35 analyses can be made by two operators per eight-hour day with a precision of 10 percent average deviation from the mean. By the fluorescence method one analyst in the field can run approximately 70 samples per eight-hour day with a precision of two percent average deviation from the mean. By either method, as little as 1.0 parts per million of boron can be detected.

Tracer Injection at Burkett Unit. The first boron tracer injection was made at the Burkett Unit, Greenwood County, Kansas, using commercial borax of 99.5 percent purity to determine quantitatively, if possible, the degree of channeling. Channeling was known to exist from input well CW-18 to producer C-25 and therefore CW-18 was chosen for the boron tracer injection. The well was taking an average of about 150 to 160 barrels per day at approximately 500 pounds per square inch. The borax was dissolved in hot water heated in barrels over an open gas fire to increase rate of solution.

The borax solution containing 30 pounds borax per barrel was added to the injection water line at the wellhead using a chemical proportioning pump. The average concentration of boron was calculated from the total number of barrels of water injected for each barrel of borax solution added (Curve A, Figure 1).

Boron injection was continued for about 34 hours except for a period of about six hours as shown in Figure 1. Results of this test showed that a minimum of 50 barrels of water per day channeled directly from CW-18 to C-25. Samples of water produced by the three other wells in the five-spot pattern failed to show an appreciable increase in their boron concentration during the 100 days following initial injection.

Tracer Injection at Scott Unit. The second injection of boron compounds was made at the Scott Unit, also in Greenwood County, Kansas, to determine whether direct channeling could account for the high water/oil ratio observed for production on this unit.

The boron tracer solution contained 25 pounds of borax and 25 pounds of boric acid per barrel, and was dissolved by circulating with a pump. This solution was added to the injection water at a rate which gave a boron concentration of 300 ppm in the input water. The rate of water injection varied from 190 to 240 barrels per day. The tracer was injected continuously into the well for nine days.

Throughout the period of injection, water samples were taken every three hours from four producers around the input well in the five-spot pattern and from one well in the vicinity but off the pattern. Samples of the input water were also taken for control of the boron injection rate. These samples were analyzed at the location, using the Klett Fluorimeter. After boron injection was completed, samples were taken daily from the five producers and sent to the laboratory for analysis.

Sampling of the five producing wells was continued for 83 days. No boron was detected in any of the

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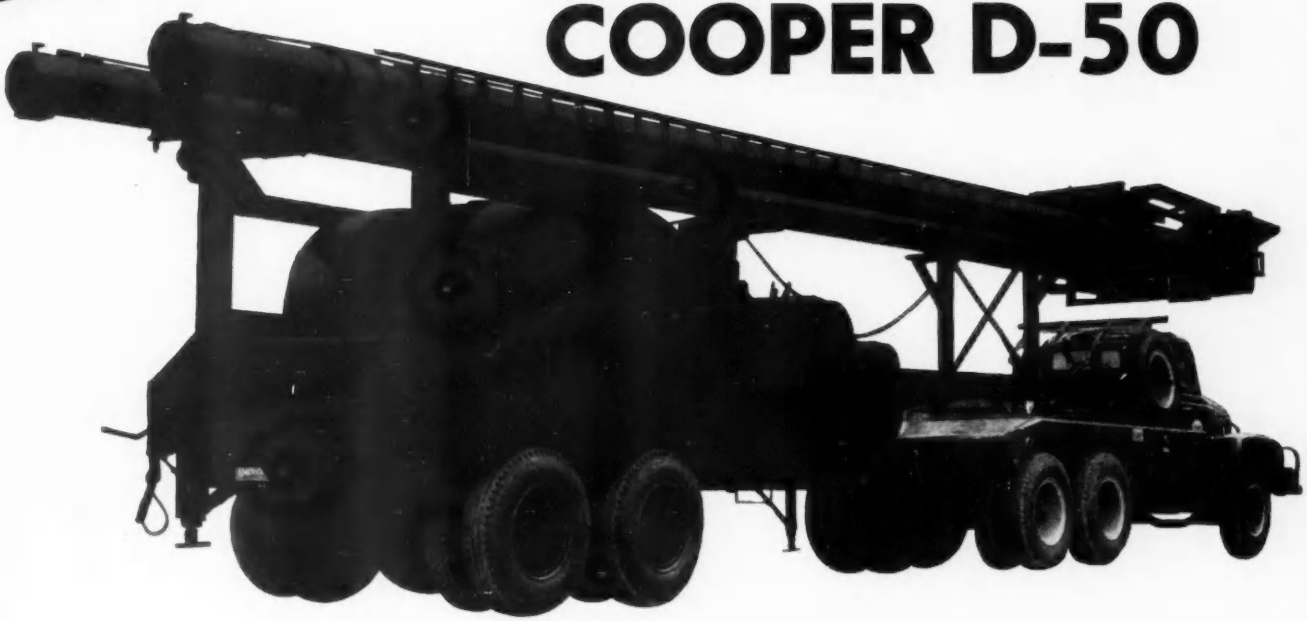

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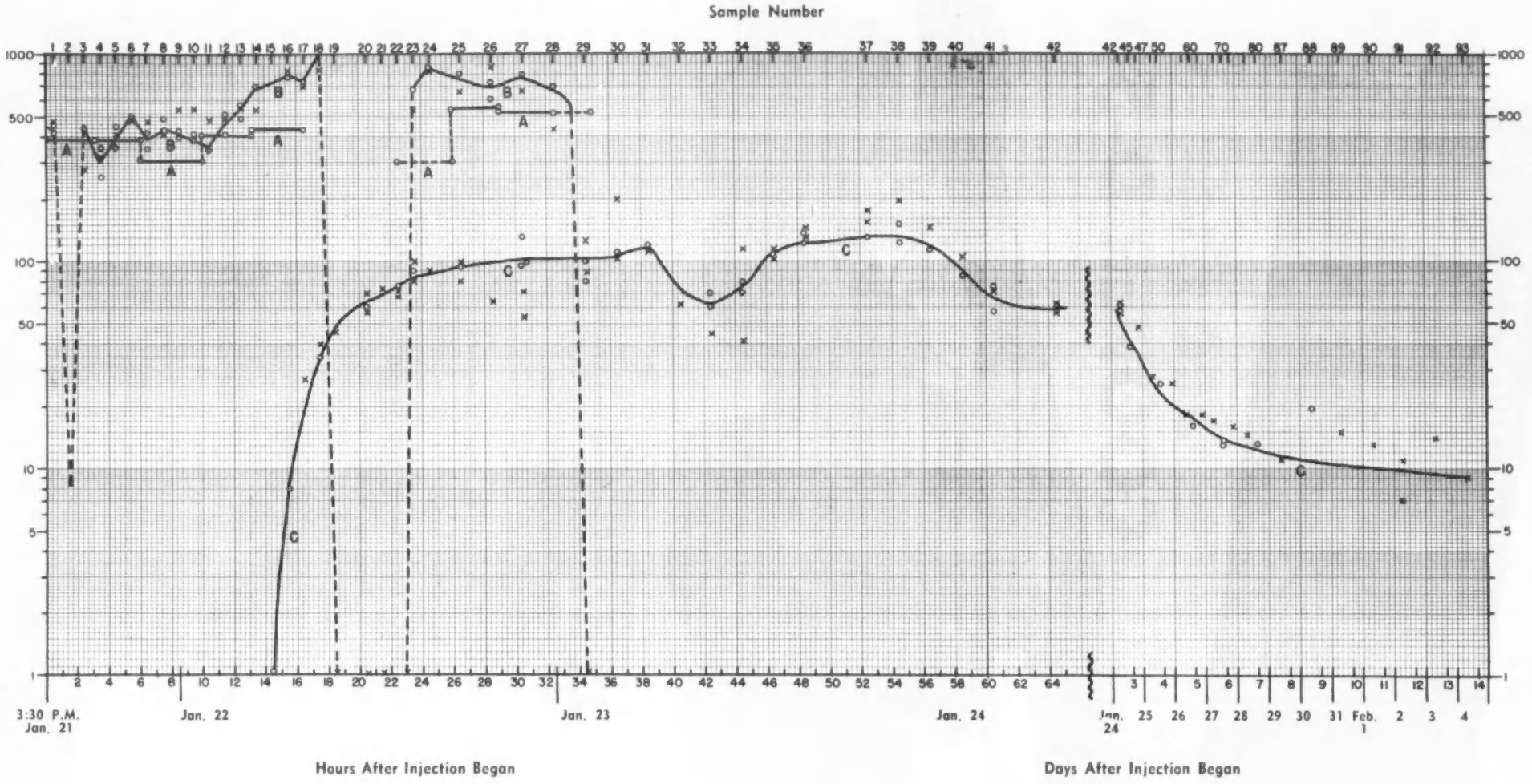
FIGURE 1. Boron content in water-flood of Burkett field, Greenwood County, Kansas.



A. Boron concentration in input water, well CW-18 (computed)

B. Boron concentration in input water, well CW-18 (spectroscopic determination)

C. Boron concentration in produced water, well C-25 (spectroscopic determination)

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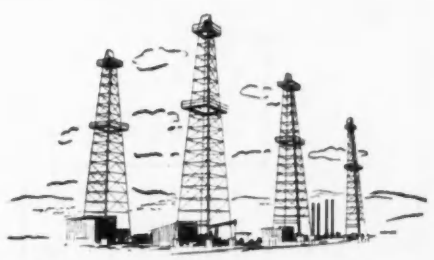

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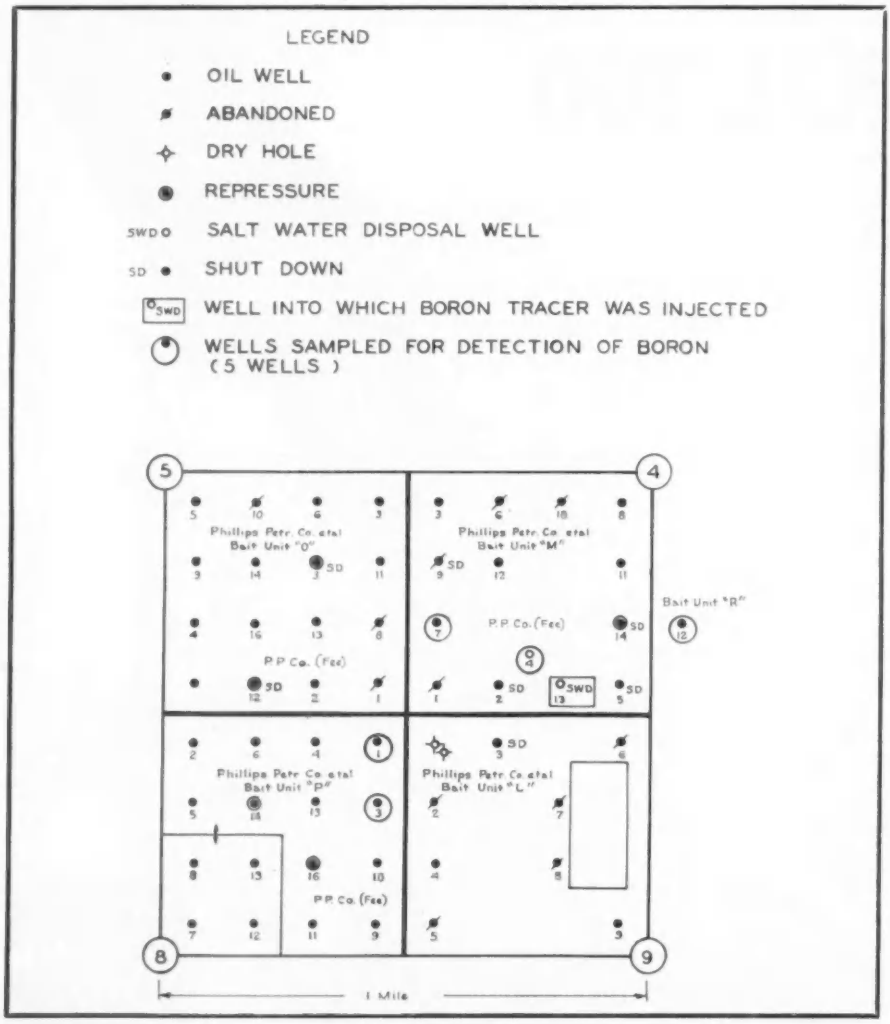
water samples from any of the five producing wells, either during the time boron was being injected or during the period following termination of injection. From these results it was concluded that there was no direct channeling of input water from the input well to any of the five producing wells.

Tracer Injection at North Burbank. The third boron injection was made on the Bait Unit, North Burbank pool, Osage County, Oklahoma, now a part of the North Burbank Unit waterflood. It was desired to determine by boron tracer technique whether water traveling through a fractured sandy shale zone possibly overlying the pay sand had resulted in widespread diffusion of injected water.

Water analyses were obtained of samples from all of the wells which might be involved, before beginning the tracer investigation. This was done to determine how much boron would be encountered as a background as well as whether there was any similarity in water from the various wells. The location of these wells is indicated in Figure 2, where the salt water disposal well M-13 is enclosed in a square, and the producing wells are encircled. The boron content of these samples (2 ppm maximum) as determined by fluorescence analysis was considered low enough to permit the detection of small increases of boron.

Water from M-7 was quite similar to water from salt water disposal well M-13 whereas water from the other wells all contained lower total solids than M-13. It was concluded that all of the water produced from M-7 could have originated at M-13, whereas if the other wells in the area produced any of this water, it was mixed with water containing lower total solids.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WELLS SAMPLED FOR DETECTION OF BORON (5 WELLS)
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Phillips Petr. Co. etal Bait Unit "M"
Bait Unit "R"
P.P. Co. (Fee)
Phillips Petr. Co. etal Bait Unit "P"
Phillips Petr. Co. etal Bait Unit "L"
1 Mile

FIGURE 2. Map showing part of Bait Unit, North Burbank pool, Osage County, Okla.

Solutions containing borax and boric acid were injected into salt water disposal well M-13 over a period of one week beginning April 20, 1949. A total of 1900 pounds of boric acid and 1100 pounds of borax was added to the 6000 barrels of salt water which entered M-13 during this period, making the average boron concentration in the input water 218 ppm. The solutions which were injected were made up by adding 150 pounds of boric acid and 100 pounds of borax to 18 barrels of salt water in a tank and allowing the solution to mix about six hours by circulating with a pump.

After mixing, this solution was pumped into another tank from which it was gravity-fed into M-13 at the rate of one to two gallons per minute. In this manner a new solution was mixed while a previously mixed solution was being injected. A rotameter-type flow indicator was used to determine the rate of flow of boron solution into M-13. An attempt was made to regulate the rate of boron solution flow to correspond with the fluctuating rate of disposed salt water flow. However, the disposal rate varied so quickly at times during each day that it was quite difficult to keep up with the fluctuation.

Water samples for boron analysis were collected every three hours from R-12, M-4, M-7, P-1, and P-3 from the time boron injection was started until noon April 23. Samples were then taken every four hours for the remainder of the injection period. Additional samples were collected from these wells daily April 27 through July 13.

Results of the analyses are shown in Figure 3. Boron was positively identified in two samples from M-7. None of the samples from wells R-12, M-4, P-1, or P-3 showed more than the background concentration of 2 ppm boron.

After boron had been identified in samples from M-7, it was decided to experiment further to determine if a "pipe line" channeling effect existed between M-13 and M-7 and to determine whether a higher boron concentration in the injection water would cause boron to appear at any of the other wells.

Second Tracer Injection at North Burbank. Accordingly, a second in-

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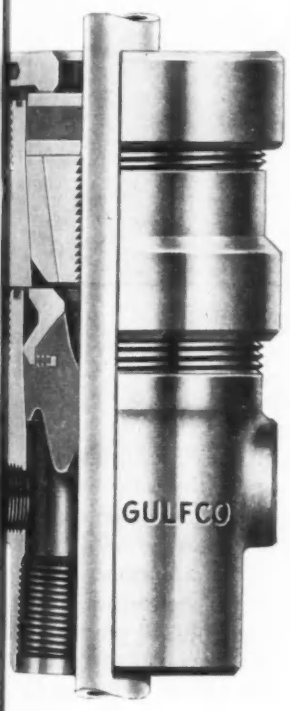

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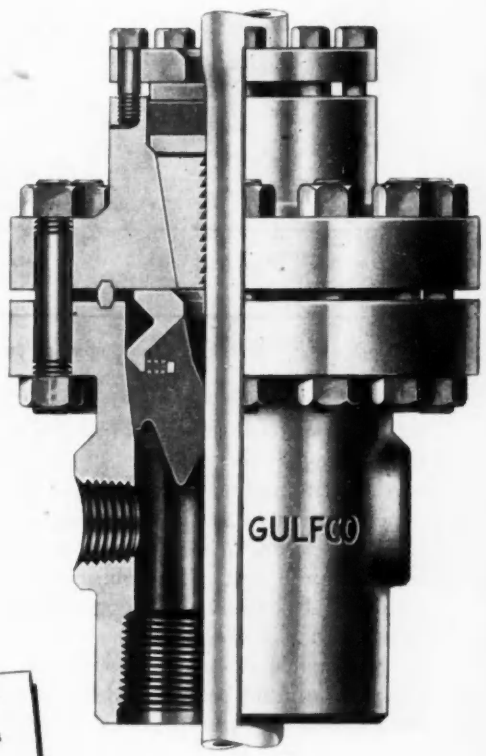
TYPE G-1 BODY WITH G-6 ATTACHMENT

The G-6 attachment is shown assembled on a Type G-1 tubing head body. The slip bowl holds the S-6 stripper in place while the tubing is being run or pulled under pressure. Suspension is accomplished by three piece hinged slips and synthetic rubber packing is compressed by tightening the gland cap screws.



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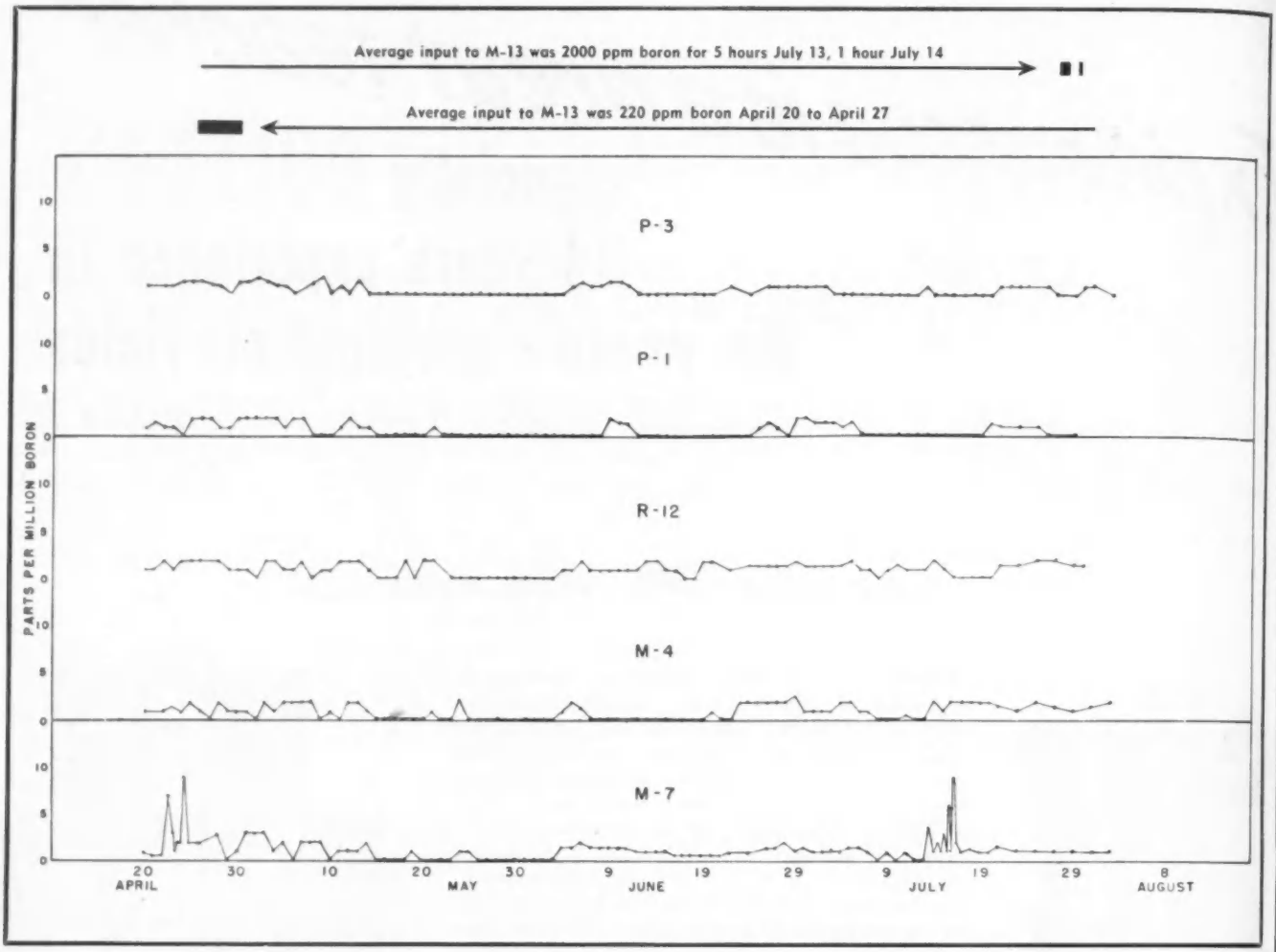

FIGURE 3. Boron log of producer wells following boron injections into M-13 of Bait Unit, North Burbank field.

jection was made July 13-14 in which the average concentration of boron was maintained at 2000 ppm. This concentration was more than nine times the concentration maintained in the initial test. The solution was prepared by adding 800 pounds of boric acid and 800 pounds of borax to 37 barrels of fresh water. After this solution had been mixed 24 hours by a circulating pump, it was gravity fed into well M-13 at the rate of about 3½ gallons per minute from 6:45 p.m. to 11:45 p.m. July 13. About 190 barrels of water entered M-13 during the five-hour period. Only 25 barrels of the solution in the tank would gravity-feed into M-13 under the conditions existing.

At the end of the five-hour injection period, the remaining solution in the tank was diluted by filling the tank with water, and this solution was fed into M-13 at a rate which gave 2000 ppm boron in the injection water for one hour on July 14, starting at 7 p.m. Water samples were collected hourly from R-12, M-4, M-7, P-1, and P-3 from 7 p.m. July 13 until 7 p.m. July 15. Additional samples were collected from these wells during the time from 10 p.m. July 15 to 5 a.m. July 16. Two samples per day were collected from July 16 to July 20. Daily samples were then collected until August 2.

The results of boron analyses of these samples are included in Figure 3. Boron was again found in samples from M-7 in about the same concentrations as before. None of the other producer wells contained measurable quantities of boron above the background concentration of 2 ppm. Boron was positively identified in five samples from M-7 collected subsequent to the injection of July 13-14.

Boron appeared at M-7 soon (20 hours) after the start of injection. No more boron appeared until 53 hours after the start of injection, when another peak appeared on the boron log. In all, five peaks appeared on the boron log, at 20, 33, 53, 55, and 57 hours after the start of injection, as shown on Figure 3.

These tests on the Bait Unit showed that at least part of the water injected into M-13 was produced soon afterwards at M-7. Since the 2000 ppm boron injection did not cause appreciably higher boron concentrations in M-7 samples than the 218 ppm boron injection, it was concluded that a single "pipe line" channel did not exist between M-13 and M-7, and that several channels between the two wells, possibly through a fractured sandy shale zone, would be necessary for the behavior observed.

REFERENCE

[1] In the Klett Fluorimeter, the sample is irradiated by ultraviolet light from a mercury arc. The fluorescent light emitted by the sample strikes a photocell and is measured by a potentiometer in a balanced cell system.

ACKNOWLEDGMENT

The authors wish to acknowledge the assistance of Edwin Fast who developed the spectrographic procedure for the determination of boron, and to thank Vernon Wheeler and Edwin Fast for spectrographic analyses; G. E. Armstrong, C. L. Merrell, W. B. Papageorge, R. F. Powell, and W. B. Prescott for assistance in carrying out the field tests, the personnel of the Production Department for their help and cooperation, and Phillips Petroleum Company for permission to publish this material.

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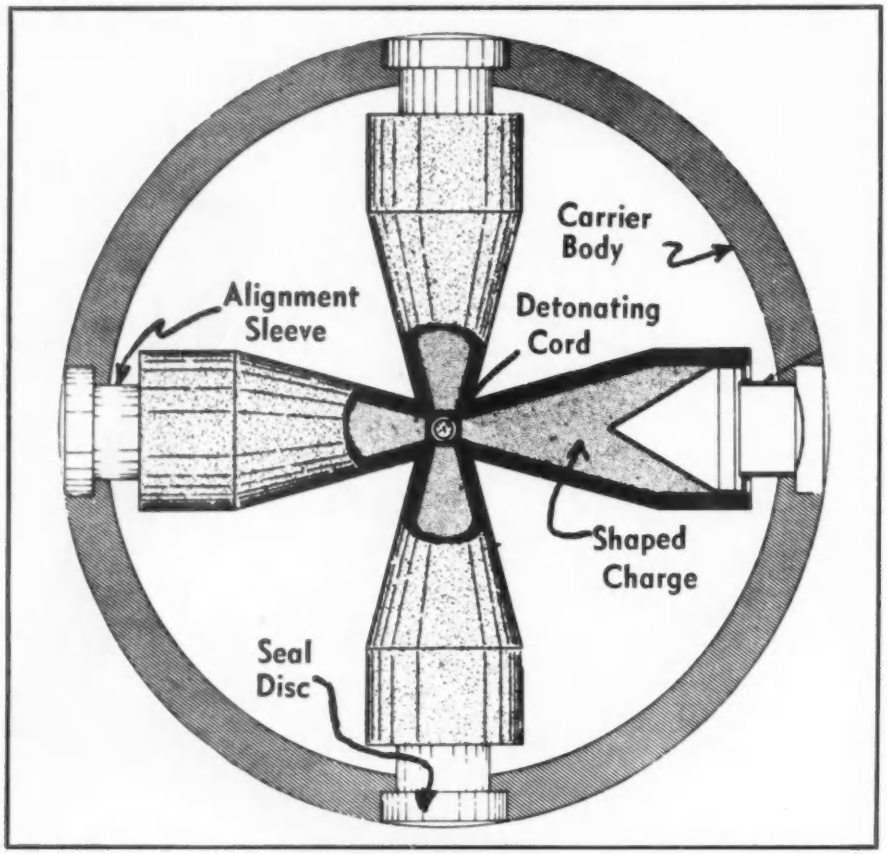

FIGURE 1
Cross-section of a type of construction for a four-way perforating useful in isolation squeeze cementing.

Four-Way Perforating Aids Squeeze Cementing

Developments in shaped charges make possible new concept that promises 360-degree coverage in isolation type squeeze cementing.

By J. E. KASTROP, WORLD OIL Staff

A NEW METHOD INVOLVING four perforations in the same horizontal plane has been field tested and proven a new aid in squeeze cementing operations. Arising out of the need for a more positive method to prevent vertical migration of undesirable fluids into the producing interval of a well, this new perforating idea has become a practical reality due primarily to recent developments in shaped charges.

Although the advantages of such a method were realized earlier, it was a practical matter of space in the perforating gun and a matter of an adequate charge that retarded field development until recently. With the high-powered shaped charges now available, it is possible to construct a four-way perforating gun wherein all charges are back-to-back inside a four-inch outside diameter casing. Number of charges range up to 12 per foot.

Even under ideal conditions where all precautions have been taken essential to a good squeeze job and when the best equipment available has been employed, it is not uncommon in recent practice to squeeze a given interval as much as four or five times to attain a satisfactory pressure buildup. For it is by a pressure test, when possible, that a positive indication of a successful squeeze job can be determined at the time.

Success of a squeeze cementing operation may be the determining factor in the economics of a producing well. For, if a successful shutoff of either gas or bottom water has not been effected, production costs may be unusually high due to excessive water production. Or, the rate of production may be penalized due to high gas-oil ratios. These objectives, coupled with high completion costs where multiple squeezing is required, or due to well shutdowns for subsequent workovers involving resqueezing has prompted considerable investigation[1] into the subject of squeeze cementing. Among pertinent questions asked that have a direct bearing on perforating are:

- Where does the cement go during a squeeze job?
- Will the cement that is forced out horizontally completely surround the well bore to form a 360-degree seal between the casing and formation?
- What assurance is there that perforations opened during a squeeze job will be sealed by squeeze cementing?

There are others, to be sure, but they are beyond the scope of perforating

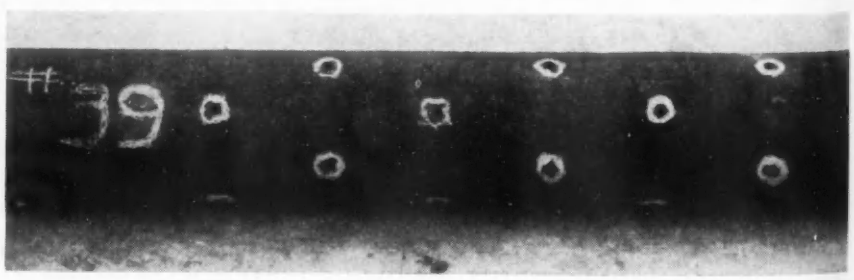

FIGURE 2
Results of four-way perforating tests on short section of 5½-inch outside diameter, 17-pound, N-80 API casing. Holes are clean with no casing splitting or bulging.

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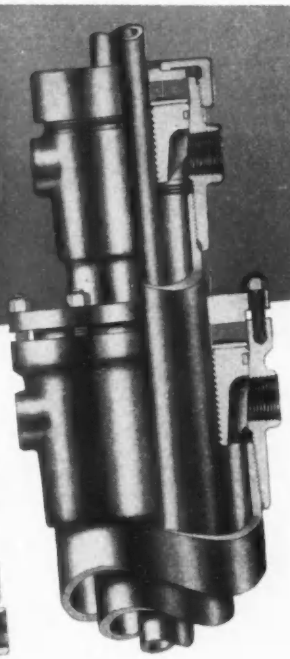
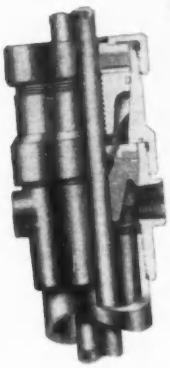
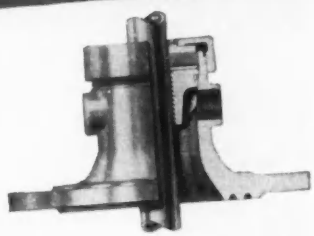


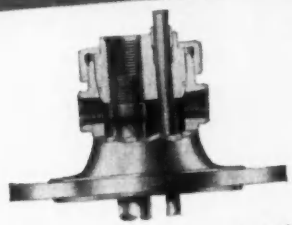


Threaded bottom Type R Tubing Head with slips and stripper. For workover jobs a second stripper can be used in place of slips in adapter bowl. Slips and stripper are interchangeable in head and bowl.

Type R Casing Head with threaded connection. Notice how ribbed construction of slips permits full flow to side outlets; also simplicity and effectiveness of sealing arrangement.



Type R Tubing Head with light flange for use on flanged casing head . . . or when replacing high pressure tubing head and tree when changing from flowing to pumping conditions.



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and concern methods and techniques.

The prime purpose of an isolation type squeeze cement operation in an oil well is to minimize if not prevent the flow of gas from the gas cap into the oil zone that is to be later perforated, or to eliminate the encroachment or coning of water into the flow pattern from the water zone below the oil. Squeeze cementing also performs other purposes, but by far these two are the principal ones.

The most desirable result in squeeze cementing is a horizontal "pancake" extending out from the casing to form a solid barrier to the vertical movement of fluids. Thickness and diameter of this pancake may vary with formation conditions of density, homogeneity, etc.

Investigations in 1949[1] to determine the lateral spread of cement included squeeze jobs on three shallow wells. Cement was squeezed through 19 perforations both singly and in sets. Resulting average lateral spread was 140 degrees per perforation. A minimum lateral spread per perforation was 45 degrees and maximum spread noted was 270 degrees. These same investigators perforated a shallow well with four shots spaced 90 degrees apart in the same horizontal plane. The sandstone opposite the perforations was broken down with 550 pounds per square inch pressure, and four sacks of standard portland cement was squeezed into the formation. Final squeeze pressure was 2500 psi. When this section was later excavated, it was found that the cement completely surrounded the well bore opposite the four-way perforations. These tests showed that by perforating the casing with four holes in a single horizontal plane that the stage has been set for the best possible results in squeeze cementing for isolation work.

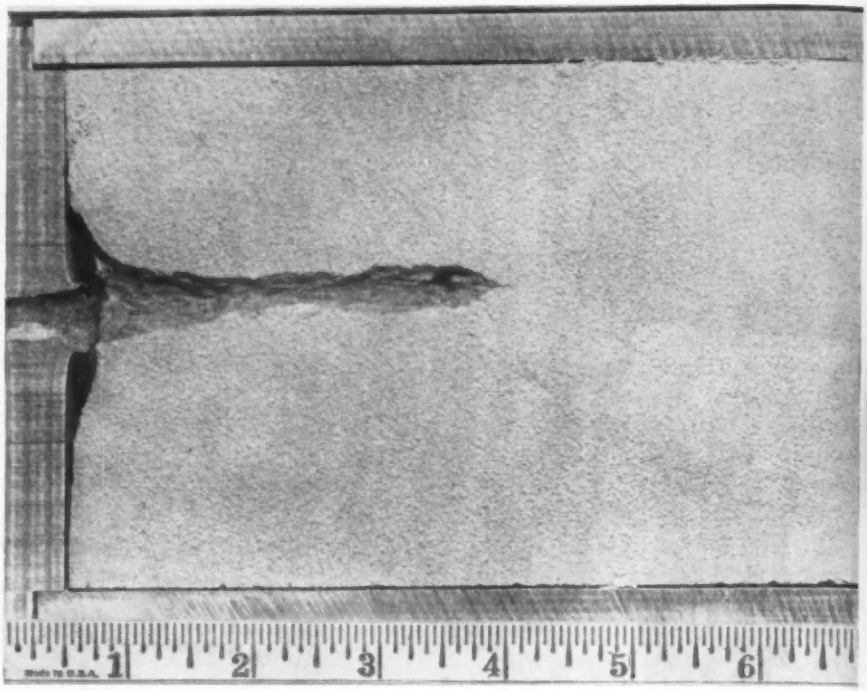

FIGURE 3

One charge fired through test block consisting of ½-inch plate steel backed up by aged neat cement. Penetration is four inches.

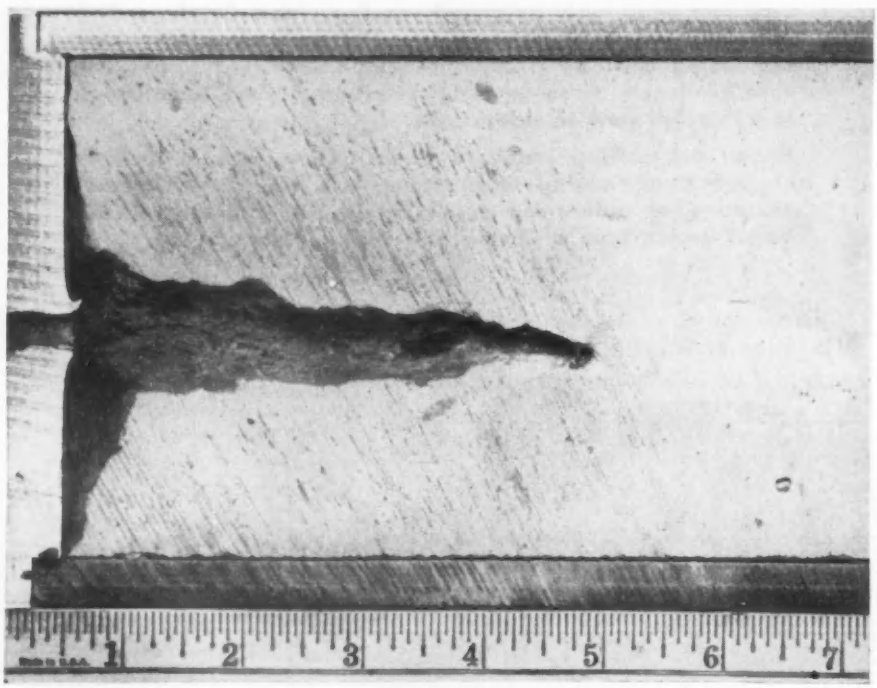

FIGURE 4

Test block showing about five inches penetration of one shaped charge used in four-way perforator. Half-inch steel plate backed up by 72-hour neat cement.

Field Results. This method of perforating in connection with squeeze cementing for isolation work has proven successful in fields along the Gulf Coast of Texas, Louisiana and Mississippi, as well as in the East Texas area. In no case involved was it necessary to reperforate and resqueeze. Results were based on well performance prior to squeeze cementing compared to subsequent performance. In a large majority of cases, where a one-time squeeze was made utilizing the four-way perforating system, results were as good as previous conventional squeeze jobs, and in most instances were considerably better. In other words, water encroachment and gas coning into the producing interval was usually reduced. Of course, where there is either water or gas fingering into the productive zone, squeeze cementing either above or below the oil section, no matter how effective the seal, will not solve the problem.

One outstanding job is pertinent here. In the Talco field of East Texas, where production is from the Paluxy

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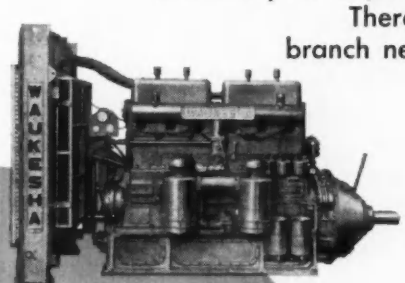

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formation, one well was producing an abnormal amount of water. Daily production was 475 barrels of water and 15 barrels of oil. Channeling was suspected from bottom waters. Production was from perforations at 4252-4256 feet and at 4260-4268 feet.

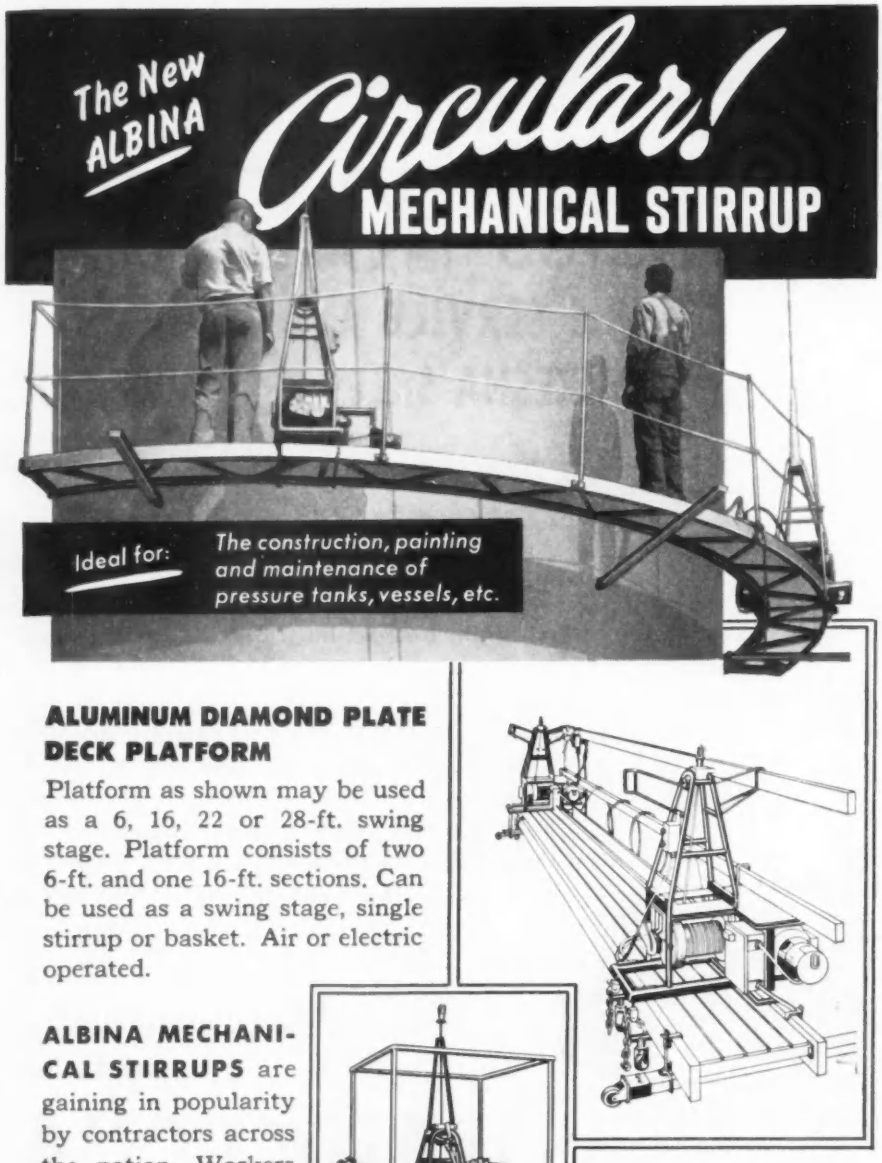
In order to seal off the water flow, four-way perforations were made from 4282-4283½ feet with 20 shots. A cement retainer was run in on the drill stem to 4275 feet and 25 sacks of cement pumped out through the four-way perforations while 500 pounds pressure was maintained on the casing annulus above the cement retainer. The pipe was backed off the retainer and picked up 250 feet. The well was then given a braden head squeeze under 500 pounds pressure. It was later cleaned out to 4259 feet. Subsequent production was 50 barrels of water and 310 barrels of oil per day. Since it is known that the sand contains some water, it was concluded that this isolation squeeze job was 100 percent successful.

The Perforating Gun. Four-way perforating for any purpose would not be feasible unless there was a practical method of constructing a gun to do the job. Use of shaped charges or "jet" charges has offered a solution to the problem of gun design for this type perforating. Figure 1 is a cross-section of a type of construction for such a gun employing four shaped charges pivoted about the center of the gun. A detonating cord extends the full length of each gun section. Successive four-way charges are located about three inches apart along the gun's longitudinal axis, and are offset from adjacent sets of charges above and below by 45 degrees.

This type gun was tested to determine the effect of splitting or enlarging casing. Several 12-inch holes were drilled from the surface to a depth of eight feet. In each hole, a short section of 5½-inch outside diameter, 17-pound, N-80 API casing was suspended in water. Bottom of the casing was welded closed with a ½-inch steel plate. Inside of the casing also was filled with water. On these tests, two-foot sections were perforated with 12 shots per foot, and one-foot sections were perforated with 12 shots per foot. After the tests, inspection showed no splitting or bursting of the casing, and the holes were clean. Size of gun was four-inch O. D. Figure 2 is a representative example of test results. Note that there are no splits originating from any perforation, and that the holes are quite uniform. With a solid cement sheath already behind the casing when originally cemented, additional support for the casing would be provided and no difficulty is expected from casing rupture when perforated.

Penetration. While this type gun offers advantages in squeeze cementing work, its use in perforating for production may be limited. This limitation arises from the expected penetration obtained in this type design. Figure 3 is a cross-section of a test section to demonstrate penetrating power of the four-way perforator. In a standard test target, using a ½-inch plate steel backed up by conventional neat cement that has set for 72 hours, penetrations of 5 inches have been measured.

Plugging Perforations. Can perforations in the casing be plugged readily by squeezing? Experience in past squeeze jobs seem to answer in part this pending question. When sev-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eral squeezes are required to obtain a satisfactory pressure buildup, it can be rightly assumed that on previous jobs at the same interval, complete plugging of all perforations had not been attained. Squeeze jobs were performed on shallow tests[1] to determine the plugging characteristics of squeeze cementing. Squeeze jobs were conducted on nine sets of perforations in four wells; five perforations were later found to be open after squeezing. On the other hand, a shallow well was perforated and squeezed five successive times, one perforation at a time. Examination later showed that all perforations were plugged. Analyses of these tests indicated that, other factors permitting, a well probably should be perforated with as few shots as practicable at the time of testing. Then, if it is found that the perforations must be plugged, they could be squeezed off without difficulty.

Unless the entire section perforated for squeezing is of uniform density, it is logical that the first cement flow will be into the less dense formations. In conventional perforating, this may account for the cement flow into some perforations and not into others, for the lithology of subsurface formations change with differences in depth. By limiting the perforating interval to a minimum and making such perforations in a narrow horizontal band where there is less chance for lithologic changes, undoubtedly better squeezing and plugging of perforations will result. Herein lies a distinct application of the four-way perforating method where four holes in the casing are made in the same horizontal plane, and adjacent sets of perforations are just three inches distant.

Thin Column Completions. One of the difficult problems associated with thin column completions is that of water or gas shutoffs. This is particularly true where only 8 or 10 feet of saturated zone is exposed to the well bore, and it must be squeezed either above or below. In such squeeze operations, the four-way perforating principle offers considerable advantages. With four perforations in the same horizontal plane, only a narrow band either above or below the producing section is perforated for the squeeze.

Formation Fracturing. From a purely theoretical standpoint, four-way perforating should prove beneficial in formation fracturing. The hydraulic fracturing fluid acts as a jack in causing the formations to split or fracture. It should be more effective if these jacks act on the same bedding plane or fracture than if they were staggered in single perforations. With four points of fluid entry at the same horizontal plane, a better distribution of the fracturing medium is obtained. By doing so, a greater area along the fracture zone is affected and thereby resulting in a greater splitting or parting force. As yet, very little field data are available to support these points.

Other Applications. The four-way perforator has found successful use in locating channels behind a primary cement job where channelling was suspected. As mentioned previously, it could be used in limited applications in perforating for production where conditions warranted. It is an effective tool when the casing must be perforated and cement spotted behind the pipe to serve as a support. Other uses include such operations as acidizing, plasticizing and in completing disposal wells.

REFERENCE

[1] "Squeeze Cementing Operations" by George C. Howard and C. R. Fast, Stanolind Oil and Gas Co., Tulsa, Oklahoma. Presented at AIME Meeting, October 5-7, 1949, San Antonio, Texas.

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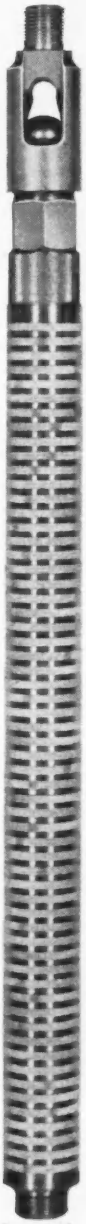

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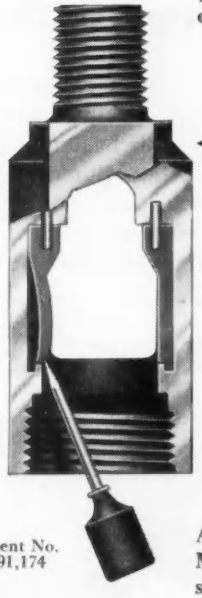

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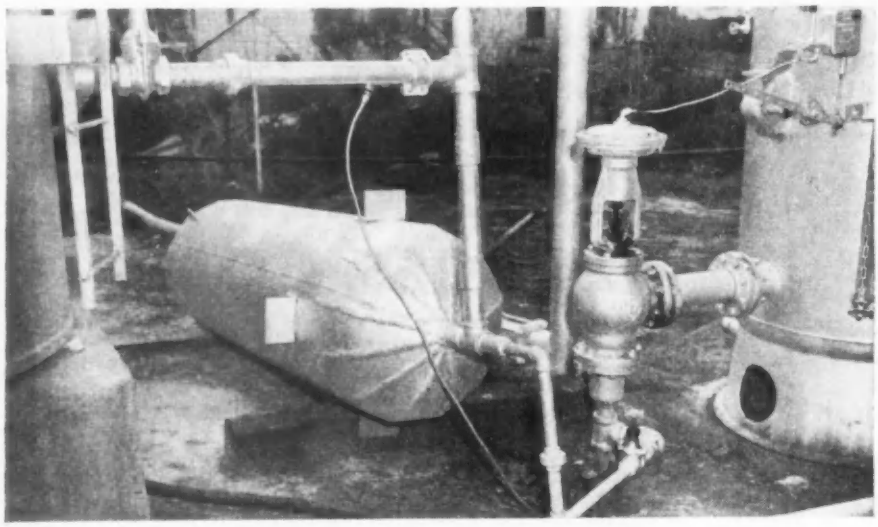


Volume Tank Adapted to Sand Trap

A pressure volume tank was adapted with exceptional results in the removal of fine sand from produced liquids upstream of the heaters. Since this well produced considerable gas the effectiveness of this sand trap upstream of the separator would be reduced, so the trap was placed in the flow line between the separator and the heater as shown.

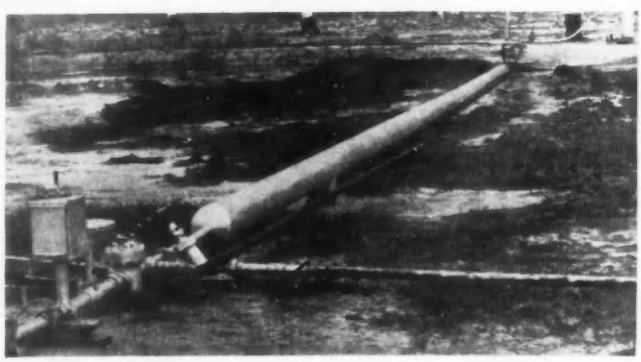
The volume tank, made from 24-inch pipe, was orange peeled and welded at each end. The far end of the tank was several inches lower than the end connecting to the flow line. A drain line and valve was also installed at the lower far end so that collected sand could be blown out.

Oil and water dumped from the separator flowed through 1½-inch pipe to a reduced swedge connected to the volume tank through a tee and short nipple. This smaller size pipe extended the full length of the volume tank and was open ended. This small line extended through the fittings attached to the near end of the volume tank so that the flow of fluids was through the small pipe to the end of the chamber where the fluids dumped in the volume tank. Oil and water then flowed through the enlarged section back up to the nipple welded at the near end of the tank. Flow was then through the tee, up the two-inch line into the heater.

By reversing the flow in the chamber, and providing a large volume which reduced the velocity of flow, the sand settled to the bottom of the sand trap. Since the tank was inclined, the sand settled to the bottom away from the fluid outlet.

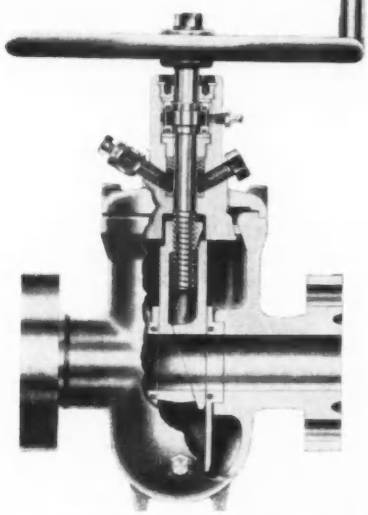
Tank Ups Gas Lift Efficiency

In intermittant gas lift service, it is necessary to have adequate volume of gas at required pressures if the installation is to be a successful one. Considerable gas can be wasted if it is dribbled through the tubing in gas lift.

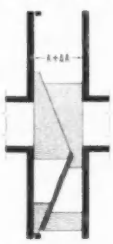


To provide the needed volume at the well and at the required pressures, the line supplying the gas for gas lift is enlarged to help provide the necessary volume. In intermittant gas lift, a slug of gas is injected periodically into the casing. Duration of injection and interval between injections are controlled by a timer and regulator valve.

Two joints of ten-inch pipe are welded together to form a volume chamber about 80 feet in length. The chamber is welded closed at either end and fitted with a collar welded into the closed end pieces. This chamber is then connected into the flow line to become a part of it as shown. The tank is placed at the well site where the gas is needed. It is inclined slightly toward the well so that any liquids or sand that might drop out of the flow stream due to the drop in velocity will fall out and settle to the far end of the chamber. Here, a blow off line is welded so that the pumper can periodically blow off the chamber to clean it out. Interval timer and control valve are located at left downstream of the volume tank. While this added tank does not contain as much volume as is desired, it is a simple way to increase the efficiency of the gas lift operation at minimum expense.



All W-K-M Valves have a perfectly smooth bore. There are no cavities or projections to cause turbulence or to collect sediment. Gates and seats are protected against cutting or damage of any kind. These advantages are a result of the W-K-M Expanding Gate development which is explained below.



In closed position, the gate (left) and segment (right) seal tightly against both seats.

When opening or closing, the gate and segment are in neutral position permitting free upward or downward movement of the gate assembly.

When open, the gate and segment again seal tightly against both seats and the bore of each lines up perfectly with the bore of the body to provide a smooth, full-round conduit.

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packers by Baker

The Baker-Otis Selective DUAL-ZONE Production Hook-Up, which includes two Baker Retainer Production Packers, permits selective production (either pumping or flowing); acidizing, formation fracturing, and other treating; or testing of *either* zone through the tubing while simultaneously producing the *other* zone through the annulus. The switch in flow, or the selection of either zone for treatment is accomplished at the discretion of the operator, using a wire line, and it is not necessary to kill the well—to move or remove the tubing string—or to disturb the Baker Packer hook-up in any way.

COMPLETION ADVANTAGES

SAVES INSTALLATION TIME—You can perforate, set the Baker Packers, and complete the well by *simply running in the tubing*. Previously it has been necessary to make *at least two additional trips* with the tubing, killing the well each time.

SAVES EXPENSIVE DRILLING RIG TIME—After the Baker Packers have been set, the tubing run in, and surface connections made, the drilling rig can be moved off. All future work can be done with a swabbing unit and a pump truck—at distinct savings.

PROVIDES SAFETY IN HIGH-PRESSURE OR HYDROGEN SULPHIDE WELLS—Surface "flanging-up" is completed before the mud is displaced. After the mud has been displaced work is performed by using a wire line and wire line tools through a lubricator. This is a highly important advantage in high-pressure or hydrogen sulphide wells.

EITHER ZONE CAN BE TESTED WITHOUT REMOVING TUBING—Not only while the well is being completed, but at any time therafter, *either or both* of the zones can be tested *without removing the tubing string* or disturbing the packer hook-up installation.

ELIMINATES EXTRA ROUND TRIPS FOR ACIDIZING OR FORMATION FRACTURING—In the past, treatment of either or both zones has been carried out *before* the packers were set. This practice not only prolonged the completion by necessitating extra round trips, but subjected the zones to the full mud load during the interval between the completion of the treatment and the termination of the packer installation. The Baker-Otis Selective DUAL-ZONE Production Hook-Up, on the other hand, permits treatment of either or both zones at any pressure that is safe for the tubing, *at any time during the life of the well.*

PRODUCTION ADVANTAGES

PERMITS SWITCHING FLOW—Should the character of either zone change at *any future time*, the flow can be switched—even under pressure—by running in the appropriate Otis Choke on a measuring line.

PERMITS PLUGGING FLOODED ZONES—If either zone should load up or flood out, it can be plugged at the cross-over.

PERMITS SURFACE WORK WITHOUT KILLING THE WELL—If at any time it is necessary to overhaul the surface equipment, the annulus can be shut off at the cross-over. All needed work can then be done *without* killing the well.

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of this new, three-color broadside which contains complete details of the Baker-Otis Hook-Up, with ordering instructions. Ask any Baker representative, or write the nearest Baker office.

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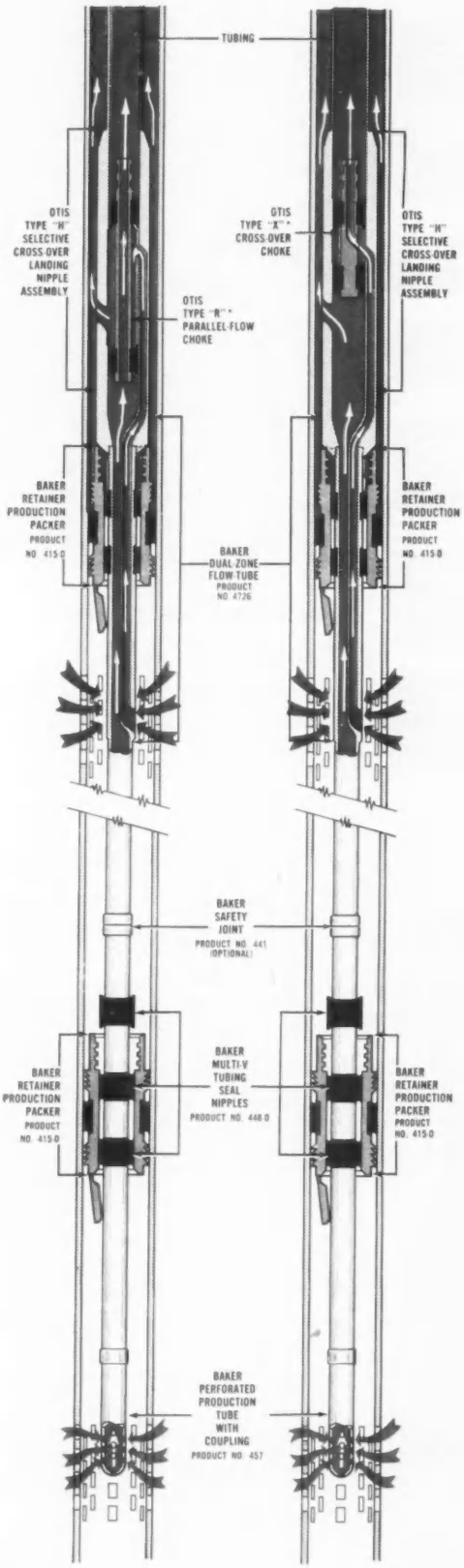
TUBING
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OTIS TYPE "X" CROSS-OVER CHOKE
OTIS TYPE "H" SELECTIVE CROSS-OVER LANDING NIPPLE ASSEMBLY
OTIS TYPE "R" PARALLEL-FLOW CHOKE
BAKER RETAINER PRODUCTION PACKER PRODUCT NO. 415-D
BAKER RETAINER PRODUCTION PACKER PRODUCT NO. 415-B
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BAKER RETAINER PRODUCTION PACKER PRODUCT NO. 415-D
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FIG. 1 FIG. 2

This is a simplified, schematic drawing.

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DESCRIPTION OF HOOK-UP

A standard Baker Two-Packer DUAL-ZONE Production Hook-Up with Change-Over Flow Tube, embodies a Special Locator Packer Sub which replaces the usual By-Pass Collar. The Locator Sub serves two purposes: (1) It connects the Outer Tube of the Change-Over Flow Tube with the Otis Type "H" Cross-Over Landing Assembly; and (2) It positions the Tubing Seal Nipples in the bore of each of the two Baker Packers.

Baker Retainer Production Packer

INSTALLATION AND OPERATION

After the Baker Packers are run and set (on wire line, tubing or drill pipe) the tubing string equipped with Baker-Otis components is run in. The well head equipment is then flanged-up, and the drilling rig replaced by a swabbing unit and a pump truck. It usually is preferable to seat the Locator Sub in the top packer before fluid-exchange operations are performed.

The appropriate chokes are then run in on a measuring line, located and locked in the Landing Nipple to permit the most advantageous flow arrangement for the initial completion, with both initial and future production possibilities in mind. At any future time the operator can switch the flow pattern merely by using a measuring line (under pressure) to retrieve the choke in use and replace it with the other choke.

LET YOUR BAKER REPRESENTATIVE CHECK YOUR NEEDS AND ADVISE YOU

Any Baker representative will gladly discuss your problems at the well; make specific recommendations; and arrange for installation of the Baker Packers and the Baker-Otis Hook-Up—Call him today.

Fig. 1—Parallel Flow

(Lower Zone through Tubing; Upper Zone through Annulus)

An Otis Type "X" Cross-Over Choke is run on a measuring line; seated in the landing nipple; and the upper zone swabbed-in through the tubing. The choke in use is then replaced with an Otis Type "R" Parallel Flow Choke, and the lower zone is swabbed-in.

Fig. 2—Cross-Over Flow

(Lower Zone through Annulus; Upper Zone through Tubing)

An Otis Type "R" Parallel Flow Choke is run in on a steel measuring line; seated in the landing nipple; and the lower zone swabbed-in. The choke in use is then replaced with an Otis Type "X" Cross-Over Choke and the upper zone is swabbed-in through the tubing.

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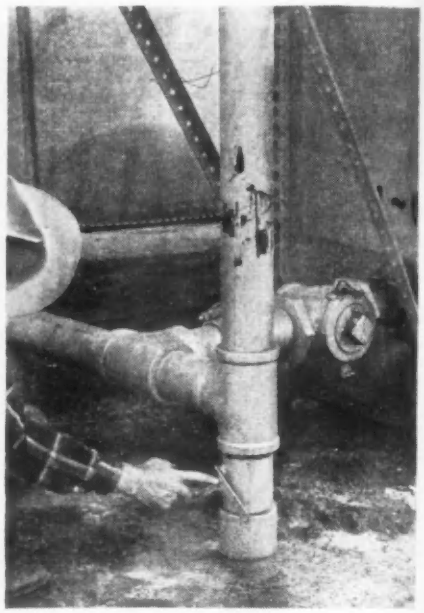

Float Prevents Gas Flow Into Oil Line

Many devices have been made and installed in gathering lines to prevent the entry of air or gas when a stock tank is dumped into the pipe line. One of the most widely used devices is a float placed in the vertical section of the four-inch drain line at the tank battery.

When the pipe line gauger turns a tank into the gathering line, oil fills the line and causes the float to rise off its seat, thereby opening the line for fluid passage. Usually, a vertical section of four-inch pipe is extended above ground, capped and fitted with an inverted "U" section of one-fourth-inch pipe. This device is a gas trap that permits any entrained gas to escape while the stock tank is being pumped out.

The idea incorporated here is based on the float and seat principle, except that the float is located below the tank outlet as shown. When the stock tank is dumped into the gathering system, oil flows through four-inch lines which connect two tanks together and dump into the one vertical line shown. The riser is the gas bleed-off described above.

When the gauger breaks the seal on the tank discharge valve and opens it, oil will flow on top of the float and fill up the gas bleed line. Before oil will flow into the gathering line, the gauger must first trip the float by the external lever shown. When the tank is empty, the float will seat, thereby sealing off the gathering line and preclude entrance of air into the line.

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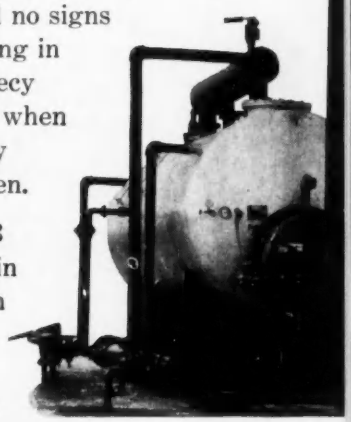

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25 feet
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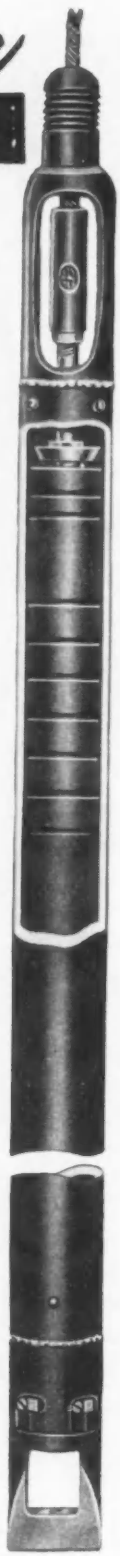

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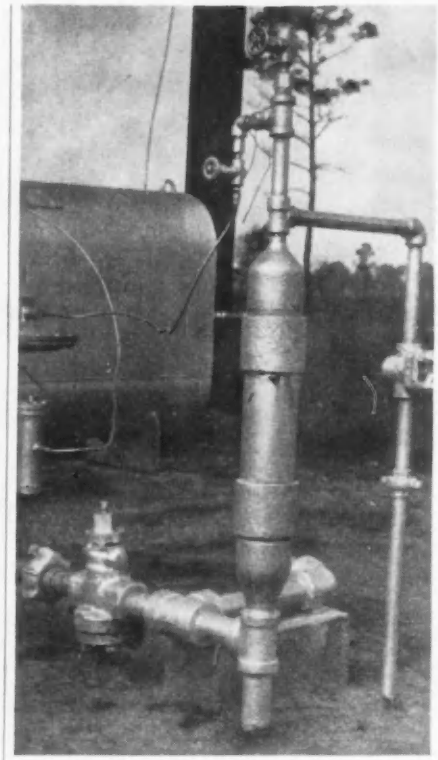
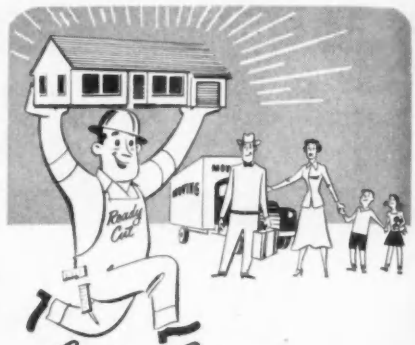


Vertical Chamber Scrubs Control Gas

Where relatively high-pressure gas wells produce some sand, water and condensate, it is possible to hook up a simple scrubber chamber to clean the gas used for control purposes. In the installation illustrated, well head pressure is 4500 pounds, and gas is produced from a very fine Micocene sand which, unless special precautions are taken, will flow into the well bore along with formation water.

To prevent freezing of the regulator shown, which drops the pressure to below 1000 pounds per square inch, a heater was installed. The regulator is downstream of the heater and is controlled by the lower pressure on the downstream side of the regulator. This control gas is supplied from the downstream line as shown.

In order to prevent fine sand from getting into the regulator control system, and to further clean the gas of moisture and condensate, an enlarged section of pipe was attached to the two-inch tee from which point the control gas was taken. To the upside of the tee, a swedge was attached so that a short vertical section of four-inch pipe could be connected as shown. It was swedged down at the top to a one-inch line that also supplied fuel to a heater-treater located nearby and to supply fuel for the in-



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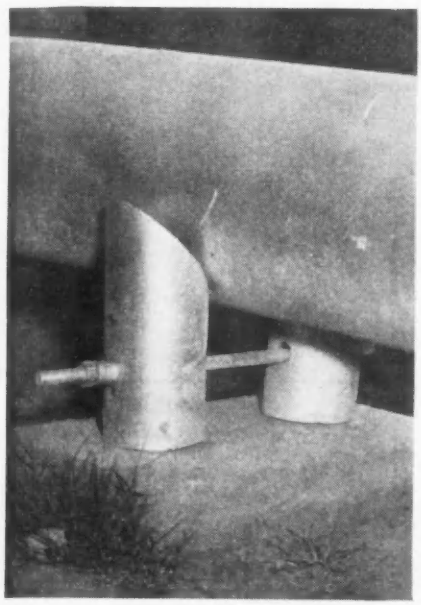
direct heater upstream of the regulator. Since the amount of gas required to control the regulator is practically negligible, any solids or liquids in the gas will fall back to the bottom in the enlarged vertical chamber. This chamber minimizes liquids carried over into the fuel system for the heaters.



Device Makes Height Of Pipe Adjustable

In the laying of large diameter pipe above ground for gas gathering manifolds, or for volume chambers in gas lift, it may be necessary to slightly tilt the pipe or change its elevation. Here is a unique shop-made device that is easy to build and yet makes it possible to adjust the height of relatively large diameter pipe above the ground.

This adjustable support is merely two pieces of four-inch pipe with one end cut off square while the other is cut at an angle of about 60 degrees with the axis of the pipe. Holes have been bored in the walls of both legs near the bottom to accept a connecting bolt. Both legs rest on a flat surface, such as a concrete pier extending slightly above ground level. By adjusting the nut on the connecting bolt, it is possible to change the height of the pipe resting in the wedge formed by both supporting legs. If a higher support is desired based on the same simple idea, it may be necessary to firmly anchor the bottom legs and allow the connecting bolt to alter the height of the pipe cradled in the support.

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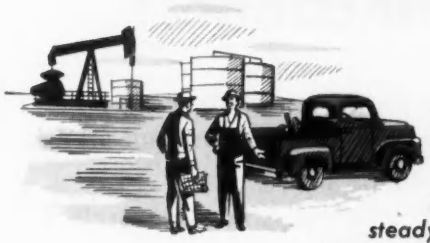

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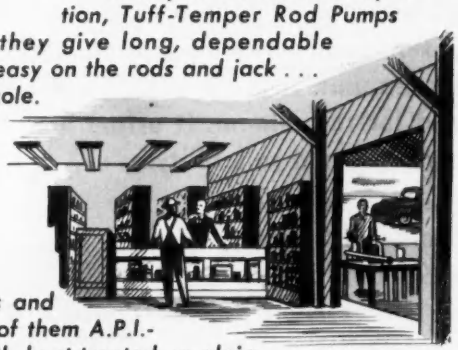
Let him tell you that under steady or intermittent operation, Tuff-Temper Rod Pumps run good . . . they give long, dependable service . . . they're easy on the rods and jack . . . they're no trouble in the hole.



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Check on the many types and sizes available . . . all of them A.P.I.-standard . . . all with heat-treated or plain barrels, chrome-plated or H-F Precision sectional plungers, as desired. Check on how many other operators are running Tuff-Temper Pumps.

ASK YOUR PUMP SHOP — They'll tell you there's no complex mechanism to worry about . . . that Tuff-Temper Pump parts are expertly machined, finished, assembled, and carefully inspected . . . that they are easy and economical to repair.

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ROD PUMPS

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Rope Hanger Is Made From Two Auto Wheels

Here is a simple device on which rope can be coiled during storage to minimize wear and damage. Two discarded automobile wheels can be easily converted into an efficient storage rack for blocks and tackle and rope. The accompanying drawing shows schematically how it is done.

The wheel is cut in half and the two halves mounted approximately 18 inches apart on a wooden or steel panel. The panel in turn is attached to a convenient and easily accessible wall space.

Amount of rope to be stored determines the most convenient distance between the two wheel halves. The top half is mounted rigidly and is provided with a metal loop for hanging the blocks after they have been drawn together or "two-blocked." The bottom half of the wheel is pivoted on a center bolt.

In storage, the rope is coiled firmly around the two half wheels. When the rope is to be removed, the bottom half is swung to either side far enough to provide sufficient slack in the ropes to allow the entire coil to be removed without unwinding. When mounted on the hanger, the rope contributes to the neat appearance of the store room and eliminates tangling.

Line Gas Powers Chemical Injector

Gas flow lines that are later found to be corroded due to moisture in the gas can be protected by injecting corrosion inhibitors at strategic points in the line. In many cases, the most strategic point may not be convenient for the installation of an inhibiting pump, but it is possible where the line comes to the surface to install such injectors.

In the case illustrated, a drip was originally installed in the line to remove moisture at a point several hundred yards from the tank battery. Sufficient inhibitor was injected into the gas stream at the well to provide protection for equipment involved for

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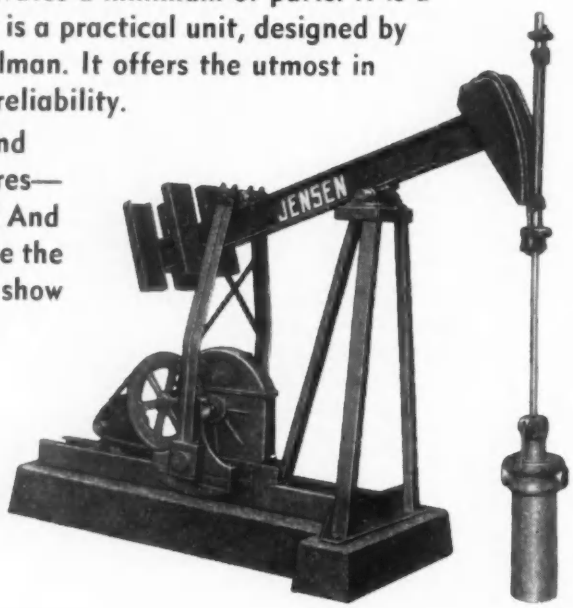

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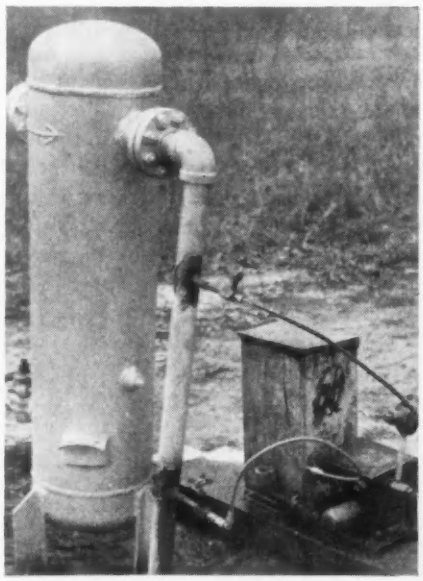

quite a distance down the flow line. At some point, however, adequate protection is not provided unless more inhibitor is injected in the line. It was accomplished here by taking advantage of the drip installation and tying into the discharge line from the scrubber.

A conventional chemical injector was used which required gas pressure to power the injecting pump. This gas pressure was supplied by a small tap welded to the discharge line and piped to a pressure-reducing regulator feeding into the pump. Inhibitor discharge was piped back into the line and a connection was welded to the scrubber discharge at a point below the tap for gas pressure. In this manner, the gas pressure in the line supplied the power to drive the pump that forced the inhibitor back into the line, thereby providing it with the protection against corrosion that was needed.

Half Drum Collects Leakage from Heater

Flanged assemblies containing burner units on old heaters have a tendency to leak around the bottom gasket due to the contraction and expansion of the flange adjacent to the burner elements. Since these units settle out much of the water in the oil, some of this water leaks around the flange gasket. Added to this is the tendency for oil that may be entrained in the gas used as fuel to spew out the nozzle where air is mixed with the gas upon entering the burner. Both the water and the oil will flow down the sides of the heater

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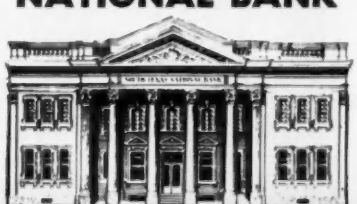
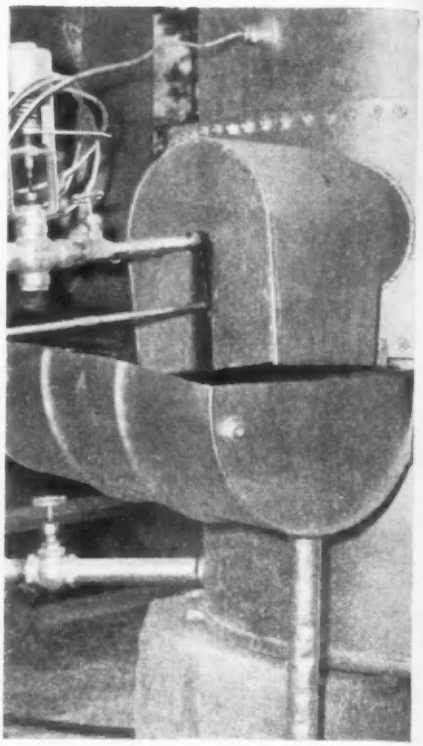


213 MAIN STREET ● HOUSTON, TEXAS
MEMBER FEDERAL DEPOSIT INSURANCE CORP.

causing it to rust and present an unsightly appearance.

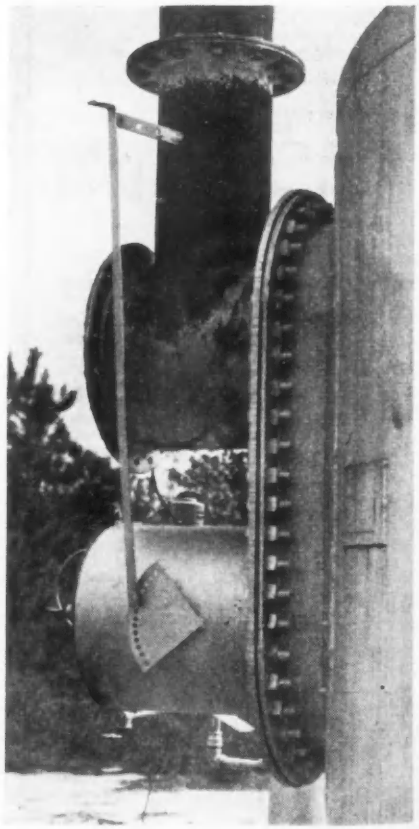
To combat this problem inexpensively and easily, one operator cut 55-gallon steel drums in half, using one half on each heater. The half drum was fitted with a drain line of two-inch pipe which was welded to the drum near one end. This end was slightly lower than the other end so that liquids would flow out as fast as they were collected. The drain line extended a considerable distance from the tank battery.

The half drum was hung from the heater by metal tabs welded to both ends of the drum where the cut was made. These tabs were drilled and bolted to the flange by using the flange bolts. Also shown in the illustration is a shop-made wind breaker for the burner and pilot. Since it is possible for high winds to blow out the flame in the burner, a slotted hood was made to fit over the burner body as shown. The lower part of the hood is open to allow sufficient air into the burner to support combustion.



Heater Stack Has Adjustable Dampner

The amount of heat required to break emulsions may vary from season to season and with the volume of fluid handled. In many cases it is desirable to change the burner setting on the heaters. A dampner placed in



Recorded experience proves beyond a doubt that well pulling costs are often cut in half while oil production is sharply increased by the use of "Page" hydraulic tubing anchors. High pressure collar leaks are minimized by stopping reverse thrust on tubing threads. Excessive wear on casing, tubing and rods, common with compression anchors, is eliminated. Reversals in the pumping cycle are smoothed out, thereby increasing pump efficiency and reducing sucker rod breakage.

FASTER HANDLING, MORE EFFECTIVE CONTROL

Page type "B" tubing anchors can be assembled in the tubing string either end up. Slips cannot be set during fastest run-in, but set automatically as oil rises in the tubing, thus insuring correct setting depth without the aid of tubing manipulation. Hydraulic principle allows compensation for temperature changes and easy release by draining tubing.

Page oil tools, including tubing anchors and tubing drains, bottom hole separators and packers, tubing couplings and sucker rod on and off attachments, shut-off valves, and sampling valves are superbly engineered for ease of handling and operation, long wear, and simplicity of design. See the Composite Catalog.

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The T-42 Self Propelled Units are *not* trucks with a winch added, but are engineered from the ground up for the specific purpose of servicing oil wells.

The engines are built for heavy duty stationary service, having ample cooling and lubricant capacities so they will not overheat at the well under the most severe service.

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and the only line of high speed tractor Well Servicing Winches. Units that will get on location and get the job done when the mud or sand is too deep for other equipment.

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The most complete line of well servicing equipment. There is a proper size and type for any field condition and depth well.

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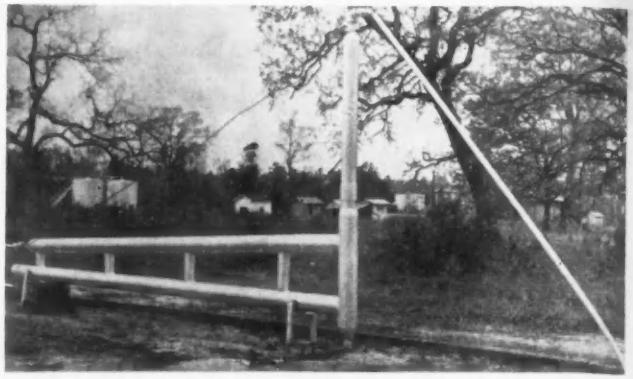
Houston, Odessa, Los Angeles

the stack of the burner unit has been found useful in accomplishing this heat change.

In this particular heater, the burner assembly consists of a large horizontal "U" shaped chamber, designed so that the exhaust outlet is located directly above the burner assembly. The stack is flanged to the bottom section so that it can be easily removed. By taking the upper section of the stack off, a dampner easily can be installed in the bottom part of the stack so that the shaft extends about an inch beyond the wall of the stack. A piece of strap steel is welded to this shaft to form a pivot arm.

Position of the dampner is controlled by a vertical arm made from strap steel and hinged to the pivot arm of the dampner. This vertical member can be raised or lowered by changing its position in a punched plate cut in the shape of a pie section. This section, representing a quarter of a circle, is welded to the housing of the burner assembly. Some 15 holes in this plate provide a multiple of settings to properly adjust the dampner so that the correct amount of heat is transmitted to the liquid contents of the heater.

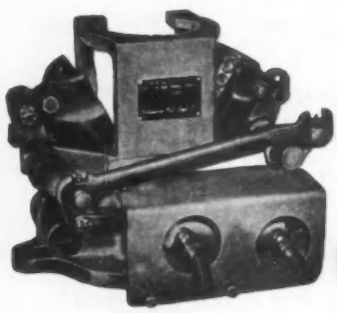
Separator Made from Salvage Pipe



Where small volumes of gas are produced with the oil, a simple gas separator can be made from salvaged pieces of eight and ten-inch pipe. Construction is quite simple. A 20-foot section of eight-inch pipe serves as the bottom horizontal leg of the separator. To the top side of the pipe are welded four vertical sections of eight-inch pipe of varying lengths, decreasing in length toward the far end of the unit.

A second eight-inch pipe 20 feet long is welded to these vertical members so that this top eight-inch line slopes upward toward the discharge end. The two-inch inlet flow line is connected to this sloping segment by means of a union connected to a short nipple welded into the blanked end of the eight-inch pipe. The vertical leg at the near end is made of ten-inch and eight-inch pipe, so that the upper end extends about ten feet above the ground. A two-inch connection is made at the top and the flow line brought back into the ground at a 45-degree angle to bring the fluid into the tank battery.

Liquid discharge from the unit is at the bottom of the short section of ten-inch pipe welded vertically to the ends of the two eight-inch sections. This bottom end is orange peeled down and welded to a two-inch nipple which in turn is connected to the discharge line feeding into the gun barrel.



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(Pat. Pend.)

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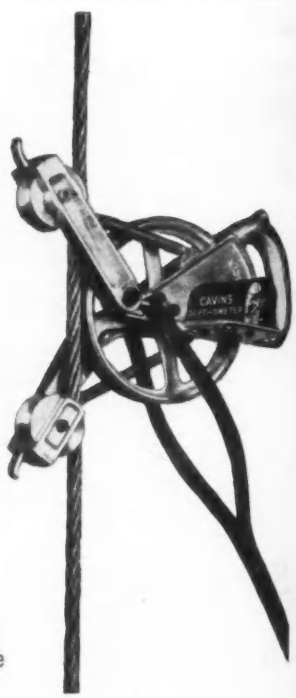
DEPTHOMETER



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Rules of Thumb

FOR THE PIPELINER'S NOTEBOOK

These formulae from the pages of engineers' own notebooks yield rough, but reasonably accurate, answers for design, maintenance and supply questions. Use them for quick calculations to solve your everyday pipe line engineering problems — and if you have a pet "Rule of Thumb," share it with others by sending it to Don Taylor, Pipe Line Editor, WORLD OIL, P. O. Box 2608, Houston.

Corrosion Protection —4—What will be the resistance to earth of a group of graphite anodes, in terms of the resistance of a single anode?

When the spacing is 20 feet (the most common value), the resistance of the group will be equal to the resistance of a single anode, divided by the square root of the number of anodes.

Example: Resistance of 4 anodes = ½ resistance of single; Resistance of 16 anodes = ¼ resistance of single, etc.

This rule is reasonably accurate, for soils which are uniform to a considerable depth; if the resistivity increases with depth, the "crowding" effect will be greater, whereas if it decreases, the individual anodes will not affect each other so much.

Corrosion Protection —5—How to estimate the monthly power bill for a cathodic protection rectifier.

Multiply the rectifier output voltage and current together, and multiply this by 1½; the result is the power consumption for one month, in kilowatt-hours. If the unit is on a meter of its own, figure the bill by the utilities rate schedule; if it represents an additional load, use the rate per kilowatt-hour for the highest bracket reached.

Example: The terminal voltage of a rectifier is 10.2 volts, and the current output is 21 amperes;

$10.2 \times 21 \times 1.5 = 321.2$; the power consumption will be about 320 kwh per month; at 3 cents this would amount to $9.60, at 1.1 cents it would be $3.42, etc.

Note that the actual current and voltage values are used; if the rating of the unit is used, the result will be the maximum power consumption within the range of the equipment. The formula is approximate; it is based on an efficiency of about 48 percent.

Miscellaneous —4—How much gas is contained in a given line section?

Multiply the square of the inside diameter, in inches, by the gauge pressure, in pounds per square inch; multiply this by 0.372; the answer is the approximate number of cubic feet of gas (standard conditions) in 1000 feet of line.

Example: How much gas in 1000 feet of 16" schedule 30 pipe at 350 pounds pressure?

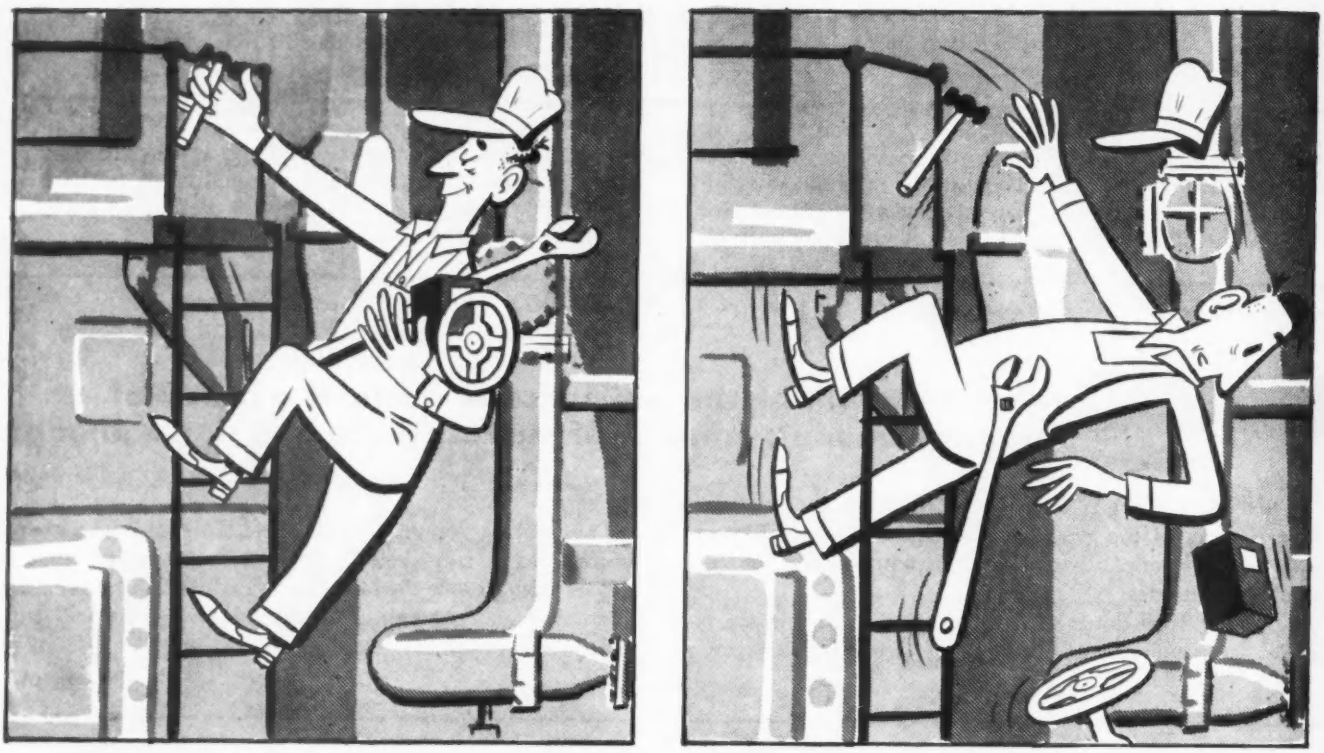
$15.25 \times 15.25 \times 350 \times 0.372 = 30{,}280$ cubic feet of gas.

Example: Approximately how much gas in eight miles of .250 wall 24-inch pipe if the pressure is 400 psi?

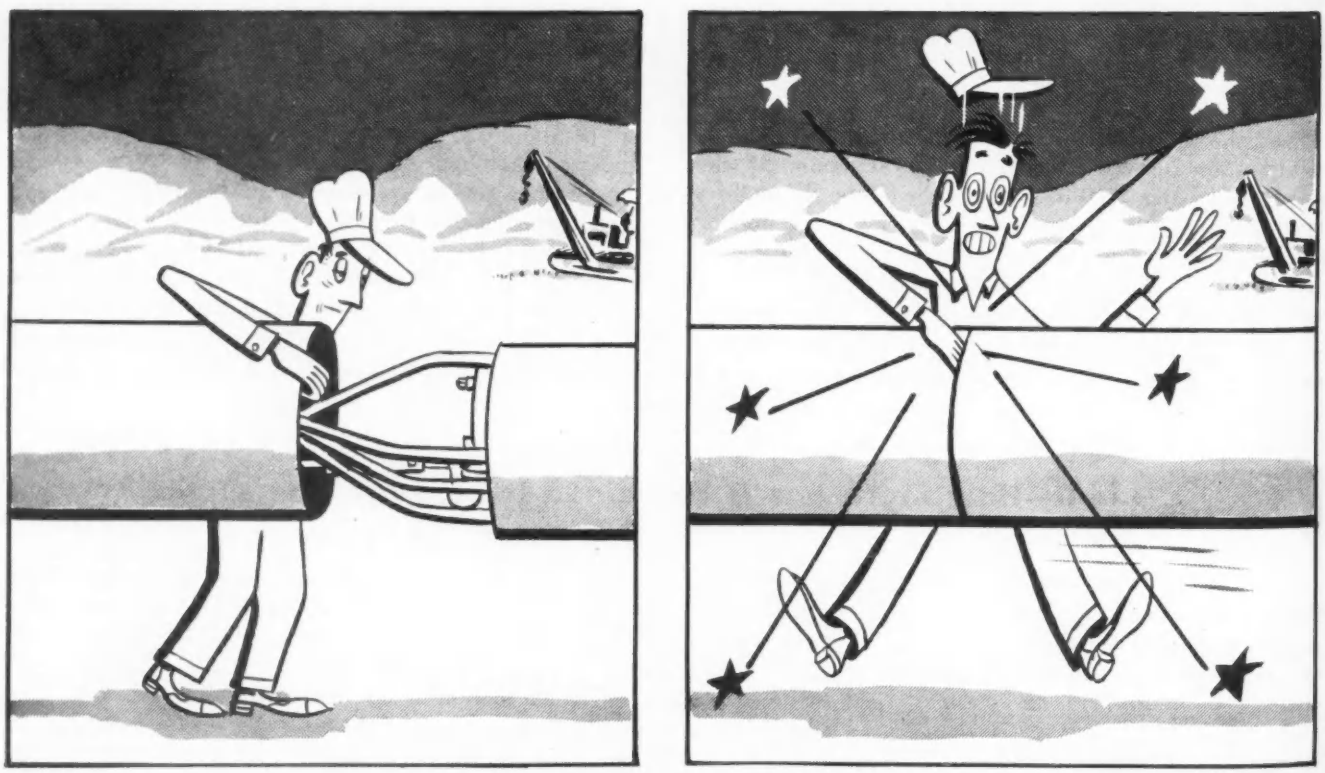
Cubic feet = $(23.5)(23.5)(400)(8)(5.28)(0.372) =$ 3,470,000 cubic feet.

When a section of line is blown down from one pressure to another, the total gas lost may be computed by the difference in the contents at the two pressures, using the above rule.

Perils of Pipeline Pete



Pete tried to save time by carrying his equipment up the ladder in one trip .... ooOOPS!



Pete was thinking of the gay time Saturday night and forgot simple precautions .... YIPES!

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Are The Guardians Of The Oil And Gas Industry's Life Lines.

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Texas Gas Transmission Corporation Photo

The Kenton, Tenn., compressor station of Texas Gas Transmission Corporation.

Texas Gas Is Still Growing

Only five years old, the company will soon have daily pipe line capacity of 1.06 billion cubic feet.

TEXAS GAS TRANSMISSION CORPORATION recently observed its fifth anniversary. But it is a company young in name only.

Formed through the merger of two veteran suppliers of natural gas to widely separated areas, Texas Gas as such became five years old on April 1. Construction that will give her 3000 miles of transmission line in nine states was resumed at the same time.

Texas Gas' predecessors, Memphis Natural Gas Company and Kentucky Natural Gas Corporation, were nearing their majorities when their operations were consolidated on April 1, 1948, and Texas Gas Transmission Corporation was formed. Memphis Natural had been organized in 1928 with a single 18-inch transmission line extending 210 miles from Monroe, La., to Memphis, Tenn. Kentucky Natural came into being in 1929 for the development of natural gas reserves discovered in a number of fields in Western Kentucky and to serve Kentucky and Indiana cities with gas from those fields.

Both grew, and when Memphis Natural and Kentucky Natural were merged the two companies had a total of 1501 miles of pipe line—Memphis Natural approximately 700 miles and Kentucky Natural about 800 miles. Memphis Natural was serving distributing companies in Louisiana, Arkansas, Mississippi and Tennessee, while Kentucky Natural was delivering gas to distributors in western Kentucky, southwestern Indiana and southeastern Illinois. Total sales by the two systems in 1947, their last full year of operation as separate companies, were 45.2 billion cubic feet. By contrast, the Texas Gas system's sales for 1952 were 239.8 billion cubic feet.

Shortly after consolidation of the two predecessor companies, Texas Gas was granted authorization to construct an 800-mile, 26-inch pipe line connecting the gas fields of East Texas and northern Louisiana with its current market areas and extending to new outlets in southern Ohio.

The new system was completed late in 1949, but within a relatively few months the full capacity of the pipe line was being absorbed by gas-hungry customers in Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, Illinois, Indiana and Ohio.

Having acquired two gas-gathering subsidiaries in South Louisiana—Louisiana Natural Gas Corporation and Texas Northern Corporation—Texas Gas added a 189-mile, 26-inch line from the heart of the south Louisiana production field to connect with the Texas-to-Ohio line at Bastrop, La. Another construction application was filed in 1951—the rapidly growing Texas Gas Transmission Corporation's third in three years—and authorization was granted for 26-inch looping of 408 miles of the original 26-inch line, and for increasing compressor horsepower. It is the last 45 miles of this looping program on which work is now under way in Kentucky. The first 363 miles of the current construction program was completed in late 1952 from Bastrop, La., to Slaughters, Ky. The Louisiana subsidiaries, with headquarters at Lake Charles, have more than 200 miles of gathering lines.

At the time of the consolidation of Memphis Natural and Kentucky Natural, the two transmission systems had compressor horsepower totaling 29,115. The 1949 construction program increased the horsepower to 69,175, other additions were made from time to time, and now, with Texas Gas' 21st station having gone on line recently, the system's rated horsepower is 140,080.

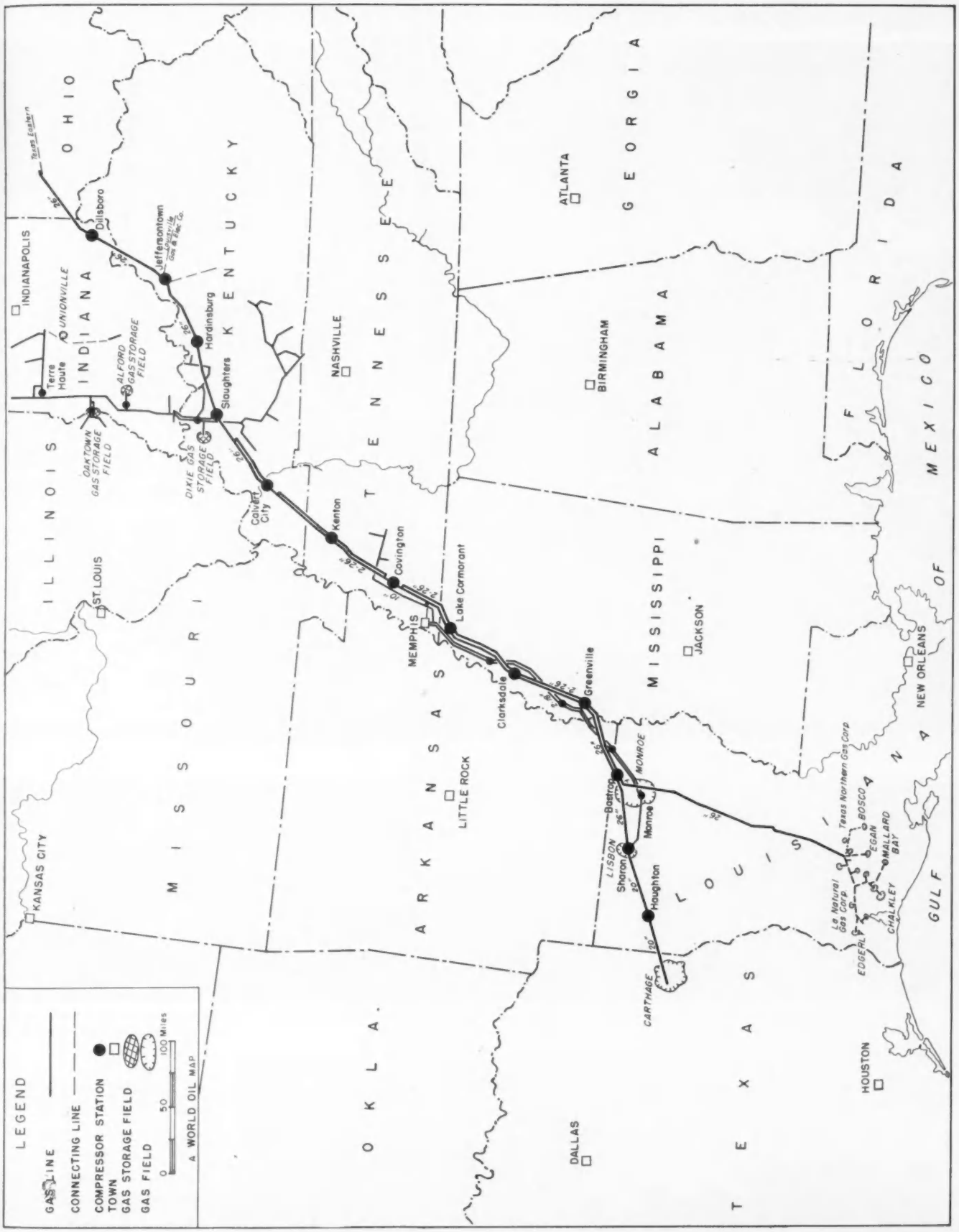
More than 30 distributing utilities that serve the Big Rivers Region (Mississippi, Ohio and Tennessee rivers) receive their gas from the Texas Gas system which has its terminus at Lebanon, Ohio. Cities served include Memphis, Tenn., Evansville, Ind. and Louisville, Ky. Headquarters for Texas Gas is at Owensboro, Ky. Other offices are located at Houston, Shreveport, La., Monroe, La. and Memphis.

Completion of the current construction project will give the Texas Gas system daily pipe line capacity of 1.06 billion cubic feet.

No. 5 of a Series

TEXAS GAS TRANSMISSION CORPORATION

Map of the Month



from Pioneering to Completed

7 Torque converter drive synchronizes tractor speed to primer.

8 With most shifting eliminated, it's easy to "walk" sections into position.

9 Pulls dope pot while cradling for wrap at matched speeds — even on hills.

13 For backfilling, too, there's an economical size to do the job.

14 The finishing touch on a job to be proud of.

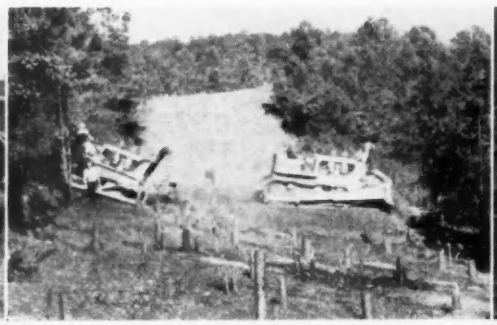
- 4 Crawler Tractor Models from 11,250 lb. to 41,000 lb.
- 4 Tractor Shovels from 1-yd. to 4-yd.
- 5 Motor Grader Models from 34.7 hp. to 104 hp.
- Wheel Tractors
- Power Units

ALLIS-CHALMERS Equipment is setting new performance standards

In every phase of pipeline construction, Allis-Chalmers equipment is making new friends through outstanding performance. Owners report that the HD-20 hydraulic torque converter drive tractor is the smoothest operating, most productive tractor they have ever used — whether pioneering with its balanced, heavy-duty blade, or when cradling pipe with the matched side boom.

Allis-Chalmers crawler tractors, motor graders, and Allied equipment are built to get more work done — stay on the job longer, are easy to operate and service. For real job efficiency, handle your next pipeline spread with an Allis-Chalmers fleet.

1 Power to "bull" through.



2 Capacity to speed right-of-way clearing.

3 Torque converter develops tremendous drawbar pull.

4 Fast stringing on right-of-way.

5 Accurate feeding to bending machine.

6 Delivering miscellaneous equipment where needed.

10 Positive boom control means sure handling of pipe.

11 Digs and hauls, or loads trucks with trench padding.

12 Boom out safely with hydraulically controlled counterweights.

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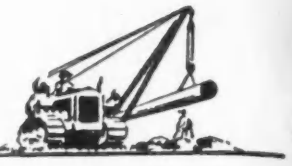
TRACTOR DIVISION — MILWAUKEE 1, U. S. A.

PIPE LINE *Construction*



By **THERESA K. MARTIN,** WORLD OIL Staff

Map of Proposed Houston Texas Gas and Oil Company line

$300 Million Gas Line Planned

The Houston Texas Gas and Oil Company has ready an application for presentation to FPC for permission to build a 1500-mile natural gas pipe line from Texas and Louisiana to Detroit, Chicago, Philadelphia and St. Louis.

The line, backed by some of the biggest oil and gas producers in the Gulf Coast area, will be designed to deliver 900 million cubic feet of gas a day to start. As diagrammed, the system would gather about 450 million cubic feet of gas per day in Texas and a like amount in Louisiana. Texas lines originating respectively in Hidalgo and Starr counties would unite into a trunk in Jim Hogg County, with a third gathering system starting west of Fort Worth and entering the main line near Marshall, Texas.

Some 350 million cubic feet of the Louisiana gas would come from the tidelands south and east of New Orleans, with another 100 million cubic feet to be picked up in North Louisiana. The Texas and Louisiana trunks would unite in the northern part of Mississippi into two parallel 30-inch lines. The St. Louis distribution line would branch off near that city, with a branch planned in southwestern Indiana to serve Chicago and a three-way branch at Dayton, Ohio, to serve the Cleveland, Detroit and Philadelphia areas.

The Houston Texas Gas and Oil Company was chartered under the laws of the State of Texas about six months ago. The incorporators are J. O. Mack, Houston independent oil and gas operator; H. S. Mack, and Al Kleikauf, also oil operators in the Houston area.

In making the announcement, J. O. Mack said, "We have lined up the gas supplies; we have arranged for financing and we have marketing commitments in the cities to be served. As of now, these cities are getting only about 50 percent of the natural gas they need."

Colorado Interstate Gas Asks FPC for Additional Facilities

Colorado Interstate Gas Company has petitioned the FPC for authority to build 49 miles of 20-inch loop on its Hugoton line from Denver to the Kit Carson compressor station, and 23,540 additional horsepower to increase the daily capacity by 83 million cubic feet.

Another application by Colorado Interstate Gas seeks FPC permission to construct 365 miles of 22-inch line from near Green River, Wyo., east to Medicine Bow, and south to Denver. Pacific Northwest would supply the gas as part of its project to carry gas to the Pacific Northwest. The Colorado application hinges on Pacific getting the green light from the FPC.

Colorado Interstate plans to start construction as soon as the government gives the go-ahead signal. It is estimated that the project will cost $43 million.

Pasotex Completes Line From Wink to El Paso

Contractors, McVean and Barlow, Odessa, Texas, recently completed laying a 200-mile, eight-inch crude oil line from Wink to El Paso, Texas, for Pasotex Pipe Line Company.

The line parallels an older system which has been in operation since 1928. Pump stations on the system were revamped so that the eight original stations have been reduced to four, where the 1200-horsepower diesel driven reciprocating pump units are concentrated.

"Most profitable equipment I've ever used in pipe-lining"

A. T. PERRY, Supt., O. R. Burden Construction Corp.

Powering this Insley clamshell is a Cat D315 Engine, one of 21 Caterpillar units in use by O. R. Burden Construction Corp. on this Illinois pipe-line job.

Years of pipe-line building experience are represented in the O. R. Burden Construction Corp. – and with that experience has come years of association with Caterpillar products. The spread on the 86-mile Illinois line between Flanagan Station and Chicago helps tell the story. There are 14 Cat* track-type Tractors on the job, as well as 7 Caterpillar Engines powering excavating machinery.

Superintendent A. T. Perry says: "I have found that Caterpillar Engines and Tractors are the most profitable equipment I've ever used in pipe-lining. These engines are economical in fuel consumption and need few repairs. The tractors are long-lived, dependable, rugged and maneuverable."

Master Mechanic Al Lundberg adds: "Cat Engines require less maintenance than any similar equipment I've had experience with. They're trouble-free but easy to work on when adjustments are needed. And, service is always available *close* to the job."

Leading manufacturers of machinery can supply Caterpillar power in the equipment they build. You have a choice of 12 engine and electric set sizes, ranging up to 500 HP and 315 KW. For full facts, call your Caterpillar Dealer. Ask him today for on-the-job proof. Let him show you the dollars-and-cents advantages of these dependable yellow units.

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United Gas Pipe Line Gets Additional FPC Hearings

The Federal Power Commission has ordered additional hearings on an application by United Gas Pipe Line Company, of Shreveport, La., to construct 31 miles of natural gas pipe lines from the Ship Shoal area field in the Gulf of Mexico to a connection with the company's existing system in Terrebone Parish, La.

In May of last year, United Gas applied for FPC authority to build the proposed new line, which would be laid for a great part under water, and would be of 20-inch diameter pipe, having a capacity of 165 million cubic feet of natural gas per day. Estimated cost of the project is $4.2 million.

In August of 1952, the commission denied United's request that its application be heard under the shortened procedure for non-contested proceedings. In November the application was denied on the grounds that the natural gas reserves available to the company were not sufficient to justify the construction of the project. This decision gave the company right to file a further application if and when it could prove availability of sufficient reserves. In December, United filed exceptions to the November decision and requested oral argument before the commission.

Texas-Ohio Gas Unsuccessful In Getting FPC Approval of Line

After a long drawn-out series of hearings, the Federal Power Commission denied Texas-Ohio Gas Company of Houston, authority to build a 1406-mile, 30-inch natural gas line which would have extended from the U. S.-Mexican border in Hidalgo County, Texas, to a terminus near Lancaster, Ohio.

The commission affirmed as its final decision an order last November 7 denying the company's application.

In the FPC opinion and order issued November 7, the commission found that the company "has failed on this record to show that the proposed service, construction or operation is or will be required by the present or future public convenience and necessity." Numerous Ohio state officials testified to the need of that state for the gas, and in its final decision, FPC said Texas-Ohio "has not made a showing that it has an adequate supply of gas to warrant the issuance of a certificate."

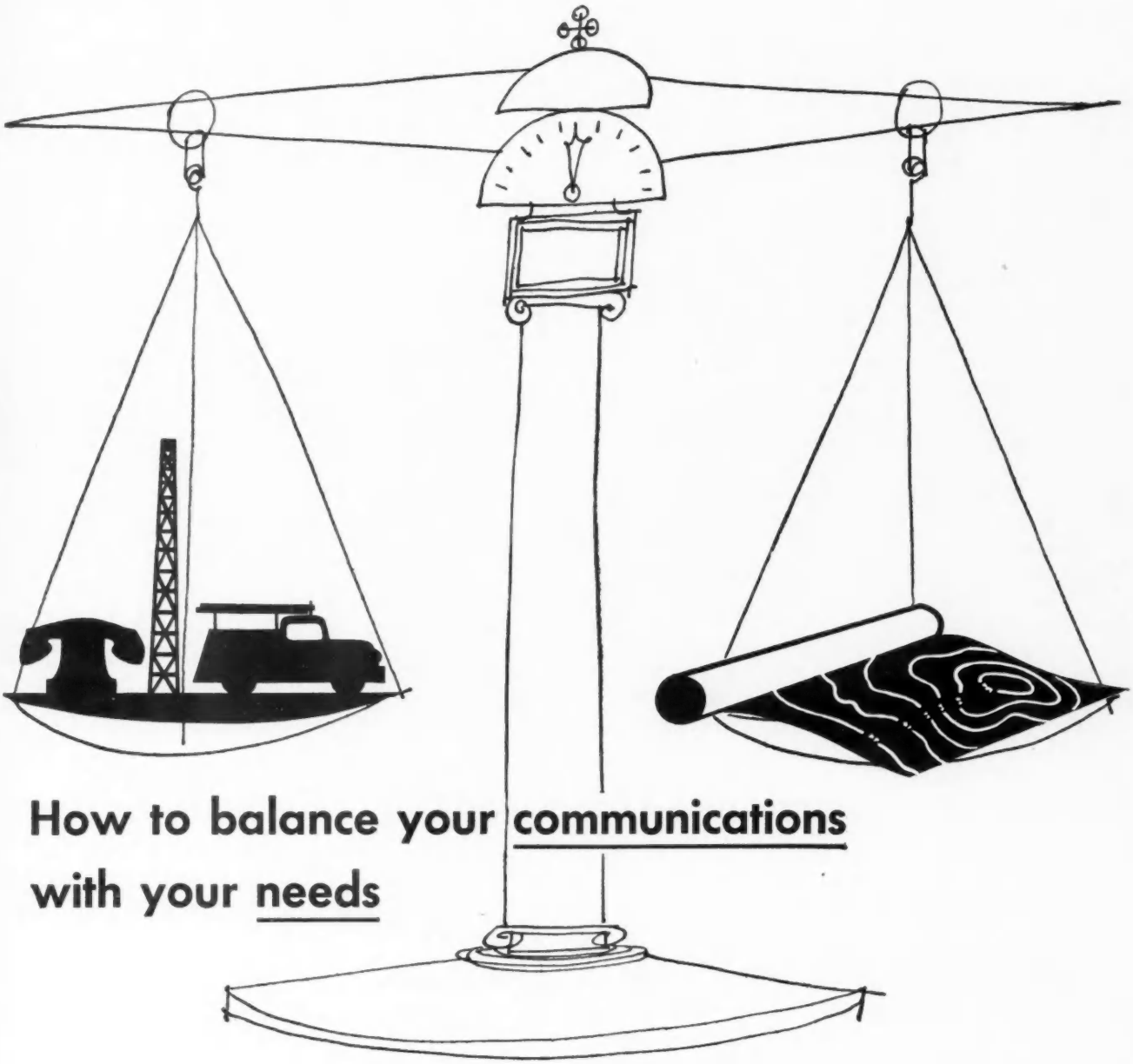
Texas Eastern Transmission Corporation officially opened its new fourteen-story office building recently. Located in downtown Shreveport, La., the building, known as The Texas Eastern Building, is completely air conditioned and has 200,000 square feet of office space. Texas Eastern uses half for their general offices, the remainder being leased. The building houses a modern cafeteria, several stores and shops, in addition to office space.

Kansas-Nebraska Gas Line Has FPC Conditional Okay

The Federal Power Commission has affirmed, with modifications, a decision by an FPC Examiner authorizing Kansas-Nebraska Natural Gas Company, Inc., of Phillipsburg, Kan., to construct pipe line facilities on its natural gas transmission system in Kansas and Nebraska to increase the daily capacity by 10 million cubic feet of gas.

The project, estimated to cost $2.5 million, includes the construction of 196 miles of pipe line, the rearrangement of certain compressors, and town border and metering stations to serve three small towns and 16 new industrial customers. Part of the new pipe line will replace sections of existing lines. The communities to be served are Wisner, Pilger and Stanton, Nebr., and the 16 industrial customers include a sugar refinery at Ovid, Colo., and 15 alfalfa dehydration plants in Nebraska. The decision also authorizes a change in the facilities previously approved for service to Doniphan, Nebr.

The commission modified the decision to include a condition requiring that no new service proposed by the company in its application be rendered until Kansas-Nebraska has initiated all firm service to all communities which it previously has been authorized to serve.



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Five Gas Firms Petition FPC To Serve Pacific Northwest

Five companies are battling for FPC rights to pipe natural gas to the Pacific northwest. They are Pacific Northwest Pipe Line Company of Houston, Northwest Natural Gas Company of New York City; Glacier Gas Company of Butte, Mont.; Westcoast Transmission Company of Wilmington, Del.; and Trans-Northwest Gas, Inc. of Spokane, Wash.

Since June, 1950, Pacific Northwest has been filing various applications to pipe gas into the Pacific Northwest area. The proposed 1466 miles of main line would extend from a point near Ignacio, Colo., in the San Juan Basin, to the Seattle and Bellingham, Wash., area. Lateral lines of 380 miles would carry gas to other cities along the route. Rep. Aspinall of Colorado said his people were very anxious for Pacific Northwest to win FPC rights as the development would be of "great economic benefit" to his part of Colorado. Further support for Pacific's proposal came from the Colorado Interstate Gas Company and the Public Service Company of Colorado, whose spokesmen emphasized there is a critical need for natural gas in the Rocky Mountain area, and if this area is to be served, it must look to Pacific Northwest as the supplier.

Northwest Natural Gas Company first made application in 1948 for authorization to market natural gas to the Pacific northwest. Amended proposals followed, the last of which includes construction of 750 miles of 18-24" line extending from the international boundary near Lynden, Wash., to Monroe, Wash., and Eastport, Idaho, also from Monroe to Seattle and Portland, Oregon. Conditional okay from the Canadian government has been given to Northwest to import Canadian gas for the $92 million project.

Three applications, made by Glacier Gas Company, a wholly-owned subsidiary of The Montana Power Company, propose to build a 626-mile pipeline system in the Pacific Northwest and to import natural gas from southwestern Alberta, Canada. The system would include a main line from the international boundary, northeast of Kalispell, Mont., to Spokane, Wash., from which lines would be laid to Lewiston, Idaho, Hanford, Wash., and Trail, B. C. Glacier originally planned to get gas from Westcoast of Canada, but has come up short as that firm has switched activities from the Pincher Creek area to Peace River fields. Last summer Glacier tried to withdraw from the consolidated hearings before FPC, saying it was not prepared for the hearing, but the request to withdraw was denied.

The approval of the FPC is the only remaining hurdle yet to be crossed by Westcoast Transmission Company, as last fall the Canadian Westcoast got provincial and dominion approval to export Canadian gas to the United States. The company's proposed $111 million project would require a 960-mile pipe line from Peace River to the border near Sumas, Wash., and 349 miles from the border connection to coastal cities in Washington and Oregon. Westcoast wants early action as the Canadian Board stipulated that the line must be completed before October 31, 1955.

A project, estimated to cost $19.8 million, is proposed by Trans-Northwest Gas, Inc., of Spokane, Wash. Gas will be purchased at International Boundary near Osoyoos, B. C. and will go to markets in Washington and Idaho. The company also plans to export gas back into Canada to Trail, B. C.

All five proposals would supply gas to the Atomic Energy Plant at Hanford, Wash. Attorneys for each company are testifying before the FPC on gas reserves and eagerly trying to prove that their project would be the "most economically feasible operation."

Platte Pipe Line Lets Contract for Extension

Platte Pipe Line Company of Kansas City has awarded a contract to R. H. Fulton & Company, Lubbock, Texas, for the laying of 91 miles of 12- and 14-inch crude pipe line in Wyoming.

This $3 million extension will enable Platte to serve directly the Byron and Oregon areas of Wyoming's Big Horn Basin. At present, the Platte line extends westward only as far as their Chatham station, which is approximately 17 miles southwest of Worland, Wyo. Total requirement of pipe has been allocated and completion is scheduled for the fourth quarter of 1953.

Platte Pipe Line Company, which is owned by the British-American, Continental, Ohio, Pure and Sinclair oil companies, recently put in operation its new $60 million, 20-inch diameter, crude oil pipe line, which is capable of transporting over 100,000 barrels of oil per day from the Rocky Mountains to its terminus at Wood River, Ill. At Wood River, deliveries are made to refineries in the St. Louis area and to other pipe lines for transportation to points further east.

New Interstate Oil Pipe Line Contract Awarded Cushing Firm

Interstate Oil Pipe Line Company announced the letting of a contract for the construction of 14 miles of eight-inch crude oil trunk line in Caddo and Bossier parishes, Louisiana. The contract was awarded to Delta Pipe Line Construction Company, Cushing, Okla.

The new line will connect with Interstate's Ida-Moore station trunk line about three miles south of Dixie and will extend southeast to a connection with the company's existing Weller-Moore line near Red Gulch, La., some six miles east of Bossier City.

The new line will provide a rerouting of the system which transports crude oil from Fouke and Spirit Lake fields in southwest Arkansas and other fields in northwest Louisiana into Interstate's Shreveport-Baton Rouge main trunk line system.

PIPE LINE PROGRESS

24-inch Rancho Pipe Line increases crude supply to West Gulf Coast refineries

Scheduled to start operation on March 1st, the new large diameter Rancho Pipe Line System, running from McCamey to Houston, Texas, supplies crude oil to Texas Oil Refineries.

Rancho's 467-mile pipe line starts in west Texas sand and caliche, traverses 270 miles of rocky country to the vicinity of Austin, then crosses cultivated fields, rivers, pecan orchards and rice fields to the outskirts of Houston.

Rancho is owned by Shell, Sinclair, Pan-American, Crown-Rancho, Nantucket, Phillips and Ashland pipe line companies. Shell Pipe Line Corporation was responsible for construction, started in March of 1952, and now operates the line. A. O. Smith supplied 340 miles of 24-inch welded steel Line Pipe for this project.

A. O. Smith is proud to have contributed to the development of this and many other large diameter crude transmission pipe lines, making possible greater efficiency and economy in oil transportation.

A. O. Smith Line Pipe is available in a complete range of sizes and wall thicknesses, from 8⅝-in. to 36-in. diameters.

FIRSTS by A.O.Smith: Welded line pipe • Internally expanded pipe • Light-wall large-diameter pipe • World's largest producer of large-diameter welded steel pipe.

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DEPENDABILITY THROUGH RESEARCH AND ENGINEERING

Magnolia's West Texas Line Scheduled for Completion

Magnolia Pipe Line Company's 47-mile crude line is expected to be completed some time this month. The line consists of 22 miles of eight-inch pipe, 11 miles of six-inch and 14 miles of four-inch pipe. It extends from the Nolley field in northern Andrews County near the county line of Andrews and Gaines counties to the Midland Station where it is connected with the Fullerton field line.

Southern Natural Gas Gives Contract to Brown and Root

Brown and Root, Inc., Houston, has a contract covering 194 miles of 6-, 8-, 12-, and 20-inch pipe line for the Southern Natural Gas Company in the area near Morgan City, La. One section of 50 miles will extend from the Mississippi River to Lake Sand Field, La. The second section consists of approximately 144 miles in the Louisiana coast area. Pipe crews were expected to start operations April 1.

Gas 'Transportation Service' Is Proposed by Tennessee Gas

In an amended application filed with FPC, Tennessee Gas Transmission Company of Houston proposes to spend $91.7 million for construction of facilities to carry natural gas owned by Niagara Gas Transmission Company of Toronto and Iroquois Gas Corporation of Buffalo. The Houston company calls this "a natural gas transportation service" and says it would not affect reserves set aside for its other customers.

If the application is granted, the company would construct a 574-mile, 30-inch pipe line from Kinder, La., northeast through Louisiana, Mississippi and Tennessee to join the present Tennessee Gas system at Portland, Tenn. Plans also include the construction of 130 miles of loop line in Texas, Louisiana, Ohio and Pennsylvania, plus 158 miles of lateral pipe lines in Louisiana and Texas. In addition, a 45-mile, 20-inch spur line would be built from the Tennessee Gas line near Buffalo to a point on the United States-Canadian border near St. Catharines, Ontario.

194-Mile Contract Given To Panama-Williams Company

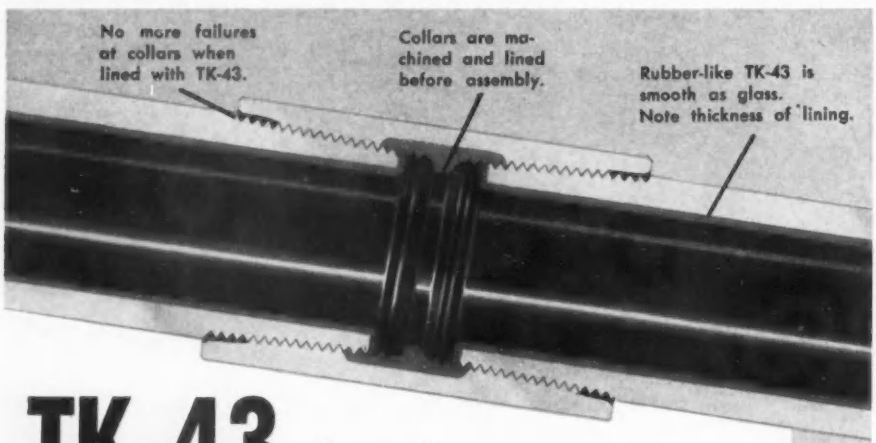
A contract has been awarded to Panama-Williams Company, Houston, to construct a 16-inch diameter, 194-mile refined products pipe line between Port Arthur, Texas, and Baton Rouge, La. This line, known as the Evangeline Products System, will be owned by The Texas Pipe Line Company, Gulf Refining Company and Sinclair Pipe Line Company. The initial capacity will be 96,000 barrels per day, and the line will transport gasoline, kerosine and fuel oil.

Work was scheduled to begin about April 1.

•

Colorado Interstate Gas Company is installing ten miles of 16-inch natural gas pipe line near its Bivins compressor station north of Amarillo, Texas, and also adding 14,000 feet of six and eight-inch line. Z. J. Graham has contracted to do the work.

Pipe is being laid on approximately 40 miles of 16-inch natural gas line between Edna, Texas, to Tom O'Conner gas field for **Houston Pipe Line Company.** Houston Contracting Company, Ltd., is doing the work.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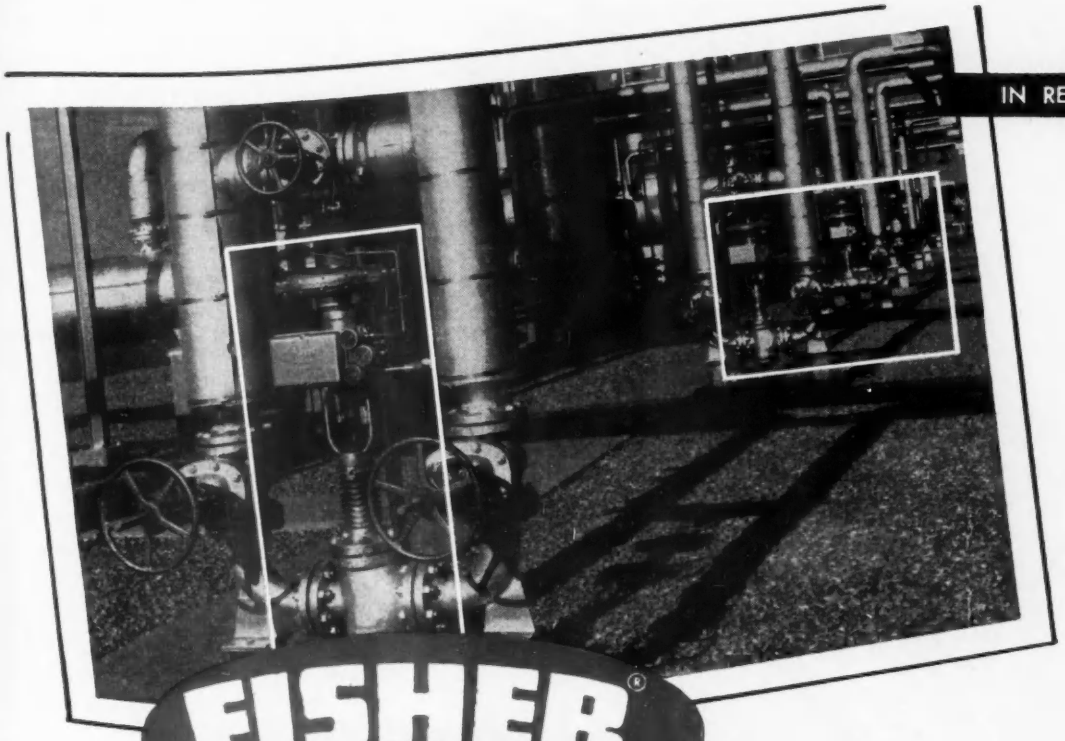

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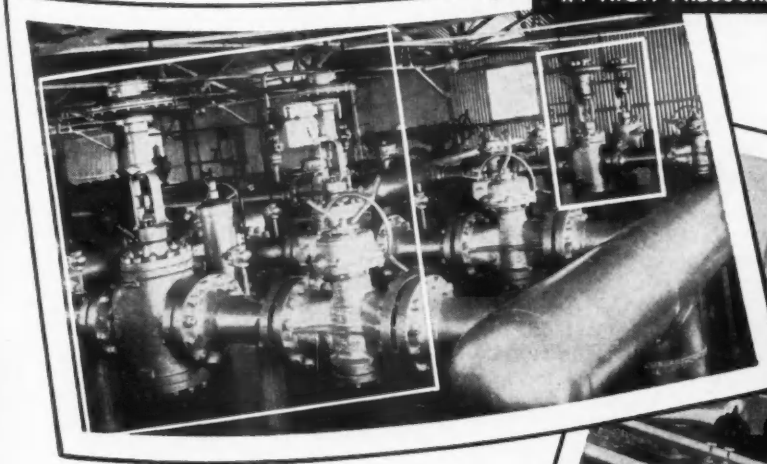

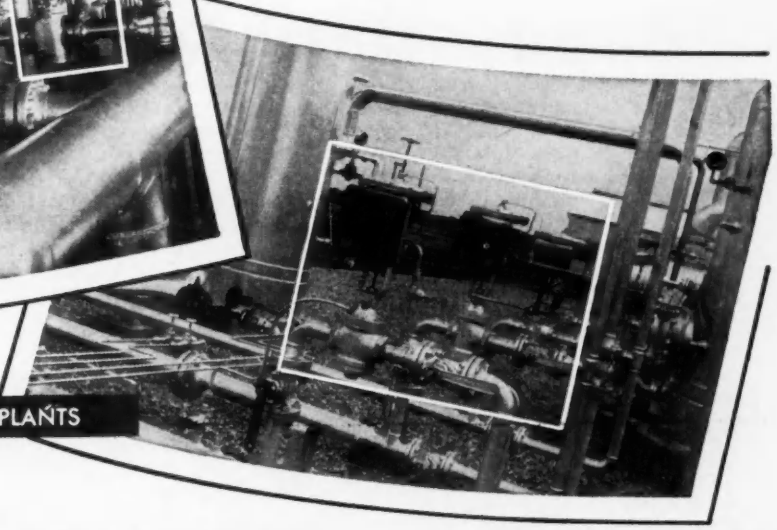

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Natural Gas Pipe Line Given FPC Conditioned Authorization

South Carolina Natural Gas Company's petition to lay 160 miles of natural gas pipe line was approved by FPC on condition that, if the securities issued to finance the project are to be privately sold, the company shall maintain competitive conditions with respect to the sale.

The project will consist of: 30.8 miles of 16-inch, 93.4 miles of 12-inch, and 35.8 miles of 10-inch. The line will extend from Southern Natural's line near Aiken, S. C., to Charleston, and will cost an estimated $5.9 million.

Ohio Fuel Gas Company Gets FPC Approval on 35-Mile Line

Ohio Fuel Gas Company has been given FPC authority to construct 35 miles of 20-inch pipe line, paralleling sections of existing lines in Fairfield, Franklin, Delaware and Licking counties, Ohio. This line will permit delivery of 50 million cubic feet of gas per day into the Holmes storage area.

In a separate application, Ohio Fuel Gas was authorized to convert five natural gas pools in Ohio to storage service, forming two new storage areas to be known as Weaver and Holmes storage areas. FPC denied the company's proposal for a third storage area, which would have been dependent upon the receipt of natural gas from Tennessee Gas Transmission Company.

In connection with the storage program, Ohio Fuel was authorized to build a 6000-horsepower compressor station in the Holmes area and approximately 97 miles of pipe line to connect the storage areas with existing transmission facilities.

South Georgia Natural Gas Receives FPC Authorization

South Georgia Natural Gas Company of Birmingham was given FPC approval to construct 335 miles of pipe line extending southeasterly from a point on Southern's line in Lee County, Ala., through southwestern Georgia and into Florida. This line will serve five direct industrial customers and will provide natural gas service to 11 communities in Georgia and three in Florida. Capacity of the company's projected system will be 20 million cubic feet of gas per day. The total cost of construction is estimated at $8.1 million.

Pipe Line Men in the News

Golden Made Vice President Of Pan American Pipe Line

Albert C. (Court) Golden, Jr., has resigned as manager of the Pan American Gas Company and has been elected a director and vice president in charge of operations of the Pan American Pipe Line Company, it was announced recently by I. O. Walker, president of Pan American Pipe Line. Golden has also been elected a member of the executive committee of this company.

Albert C. Golden, Jr.

Golden, a native of Sidney, N. Y., finished high school in Albany, majored in mechanical engineering at Rensselaer Polytechnic Institute in Troy, N. Y., and came to Texas in 1936. After two years of "shovel" experience in the oil industry in West Texas and New Mexico, he entered the service of Pan American Production Company in 1938 as a roustabout in the Charenton field, Louisiana. During the next ten years, he served in various capacities in a number of fields in which the company operates in Texas and Louisiana. In October 1948 he was transferred to Houston as assistant to the vice president of Pan American Production Company, and on Jan. 1, 1950, was appointed manager of Pan American Gas Company.

They Represent Pipe Line Contractors for 1953

The men shown above comprise the slate of directors and officers elected by the Pipe Line Contractors Association at the annual conference in January. Back row, left to right: Robert D. Sheehan, president of Sheehan Pipe Line Construction Company; J. C. Britton, president Britton Contracting Company, Inc.; R. H. Fulton, president R. H. Fulton & Company; Earl Allen, president of Associated Pipe Line Contractors, Inc.; T. A. Hester, president of Oklahoma Pipe Line Constructors; G. A. Manuel, president of Williams-Austin Company; and R. P. Gregory, partner Houston Contracting Company. These men are all directors for the association.

Officers appear in the front row, left to right: James P. Neill, vice president, and president Western Pipe Line Constructors, Inc.; Felix Johnson, Trojan Construction Company, Inc.; Robert Thomas, president and president of Texas-Louisiana Contractors; Robert A. Conyes (retired president), Conyes Construction Corporation; C. C. Bledsoe, secretary-treasurer and secretary-treasurer of Midwestern Constructors, Inc.; J. E. Honee, Latex Construction Company; and Richard A. Gump, executive secretary, Dallas.

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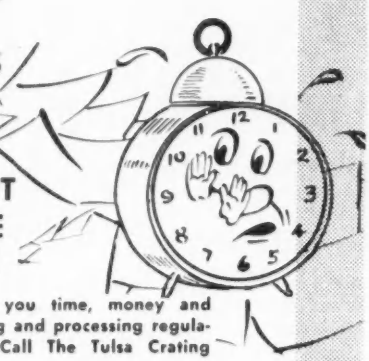

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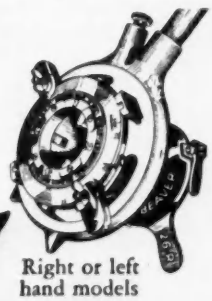
BEAVER NO. 26-R
1 TO 2-INCH PIPE THREADER



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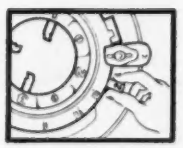
• The new Beaver 26-R is a greatly improved and simplified successor to the "old Beaver 26," popular for 40 years. Drive ring is on top—in line with dies for easy cutting. Oversize, undersize or standard threads can be cut of uniform length. Has "radio dial" setting. Change size in 2 seconds without tools. Standard taper or electric conduit threads. One set dies. No bushings.

Radio Dial Setting Change in 2 Seconds



Dies Easily Removed from Outside

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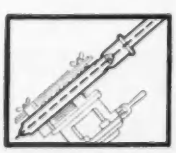
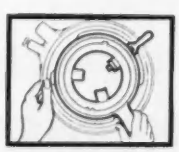
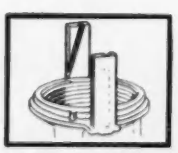
254-300 DANA AVENUE • WARREN, OHIO, U. S. A.
"Over 50 Years of Friendly Service"



Straight Line Pull Easier Cutting



Universal Chuck · Accurate Centering · No Bushings



Cuts Taper or Straight Threads

O. F. Moore Is New President Of Pipeliners Club for 1953

The new president of the Pipeliners Club for 1953 is O. F. Moore, vice president of The Ohio Oil Company and manager of Ohio's Pipe Line department.

O. F. Moore

Moore, a native of Indiana, joined The Ohio Oil Company in November, 1909, as a stenographer and clerk at Robinson, Ill.

Moore has been active in affairs of the American Petroleum Institute and for some time has been a member of the Central Committee on Pipe Line Transportation, and since 1951 a member of the board of directors of API.

Southern Natural Names R. G. Bott to New Post

R. G. Bott, formerly assistant chief engineer at Reform for Southern Natural Gas Corporation, is chief engineer at the new Gallion station. W. E. Pierce, assistant chief engineer at Perryville, becomes chief at Elmore.

Other changes in Southern Natural's personnel include C. M. Bryan, chief engineer at Pickens station, who has been named to the same post at Logansport station. E. E. Elmore, chief engineer at Elmore, takes over as head man at Pickens, and E. M. Bolling moves from chief at Ben Hill to the same post at the new Gwinville station.

Pipe Line Officers Confer

The three principal officers elected at the Shamrock Hotel, Houston, by the fifth annual convention of Pipe Line Contractors Association found time to confer together. They are left to right; James P. Neill, vice president; Robert Thomas, president; and C. C. Bledsoe, treasurer.

Panhandle Eastern Adds Two New Radio Engineers

Panhandle Eastern Pipe Line Company has added two new radio engineers to its communications departments. Hugh Edwards, formerly of Northwestern Bell Telephone, is the radio engineer at Paola, Kan., while Curtis Denison is the radio engineer at the new communications building at Pittsfield. A new laboratory has been constructed at Dodson, where C. L. Rhodes, former radio engineer at Paola, has been transferred.

J. A. Fowler, superintendent of communications, announced that a preliminary expansion of the company's microwave system has been completed as far as Zionsville.

•

Robert G. Bushnell has been elected a vice president of The Buckeye Pipe Line Company and Arthur G. Helmbrecht has been appointed assistant to the president.

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LINE PIPE COUPLINGS A.P.I.
⅛" to 12"—Seamless and Special Processed—Black or Galvanized

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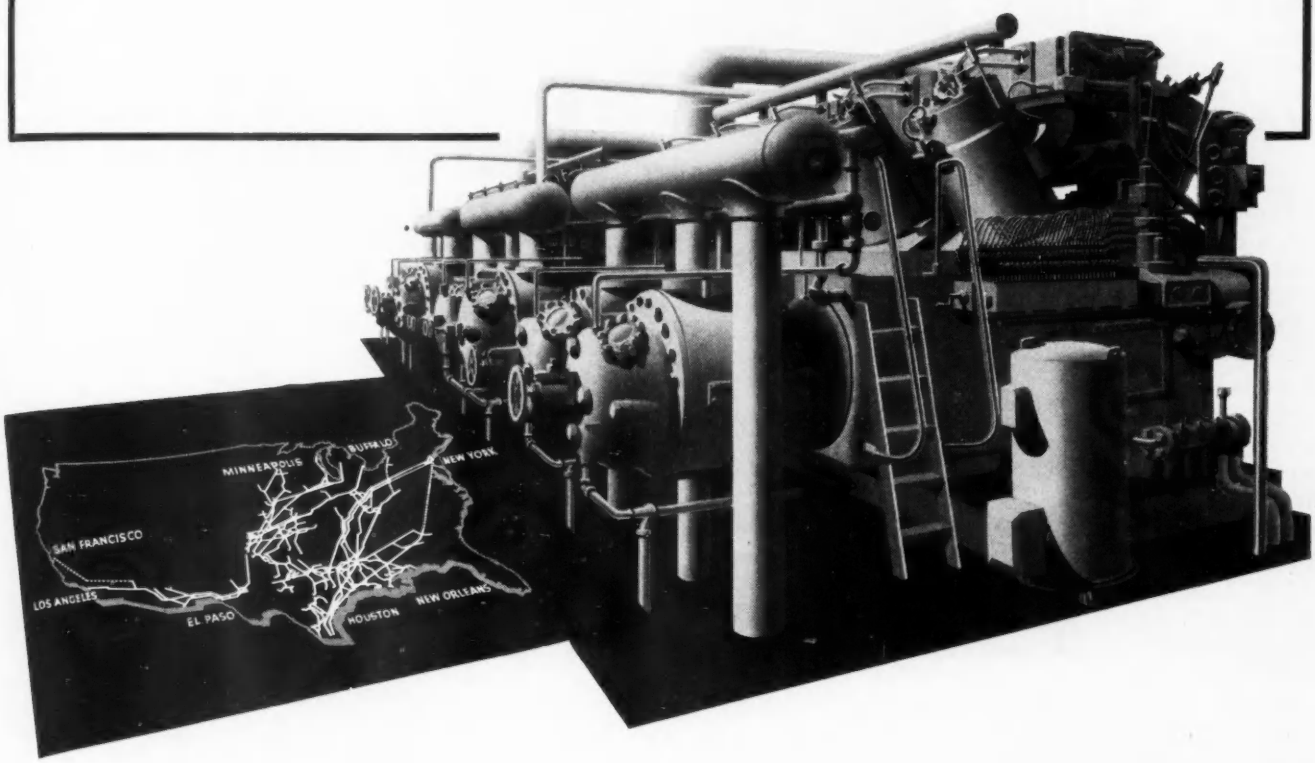

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Because of its excellent resistance to oxidation, Gulf Security Oil stands up for many hundreds of hours without any appreciable change in its original properties. After years of operation with this quality lubricant, equipment shows remarkable freedom from cylinder wear and a minimum of carbon deposits on valves and rings. And because oil control rings are kept clean, oil consumption is remarkably low.

Operators of the many units lubricated with Gulf Security Oil report that this quality lubricant helps them get more operating hours between overhauls, and avoid unscheduled shutdowns.

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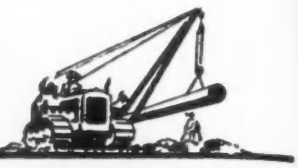
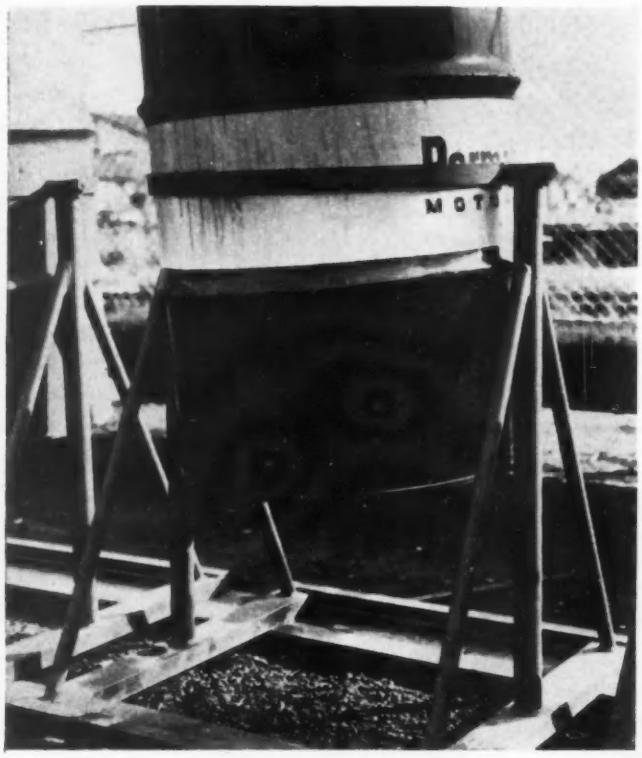


$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

Barrel Sling Makes Filling Easy

"Get two men and a boy and fill this kerosine can," might be an order where this "barrel sling" is not in use. With it in use even the boy could fill a can with kerosine, oil, gasoline or whatever the 55-gallon drum contains.



The base is made with two 30-inch lengths of channel iron with cross braces of angle iron. Upright posts are 1½-inch pipe braced with one-inch pipe. The band around the barrel is 1¼ by ¼-inch strap iron just large enough in circumference to hold the 55-gallon drum. Notice it is bolted so it may be drawn up tight after the drum is in place.

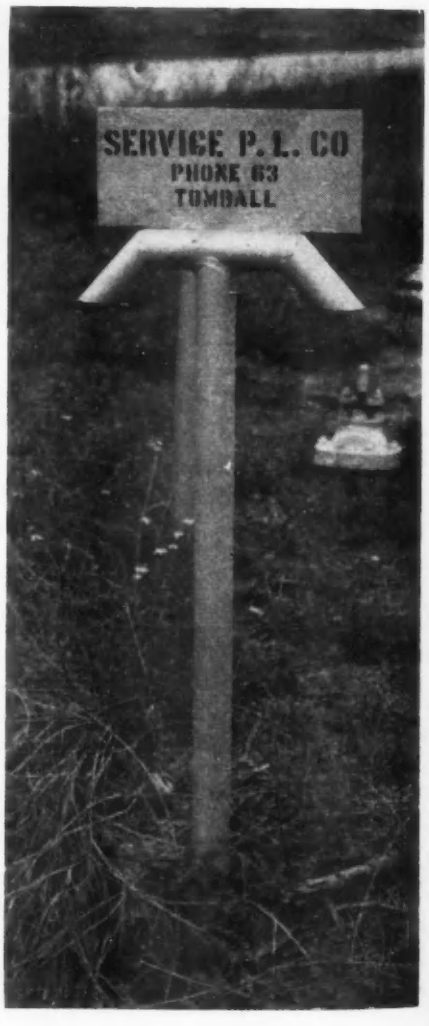
The top of the 1½-inch pipe is notched and a short section of angle iron is welded into the notch. A short length of ⅞-inch steel rod is welded to the band on opposite sides of the drum to form an axle for it.

In this particular instance, the drum remains in the sling and is refilled from a tank truck. But with its convenient axles projecting from either side, it could easily be handled by men or by a gin truck.

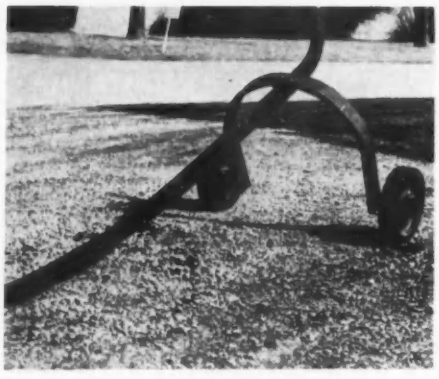
Sign Board Made Of Casing Vent

Tack-weld a steel plate to the top of a road casing vent and list the emergency phone number or other information you may want to make available to passersby.

You couldn't pick a better location. The vents are located at road crossings and their very presence advises the casual observer that a pipe line is underfoot. By listing the name of the company and an emergency number to be called in case of trouble, you can turn passersby into line walkers for your company.

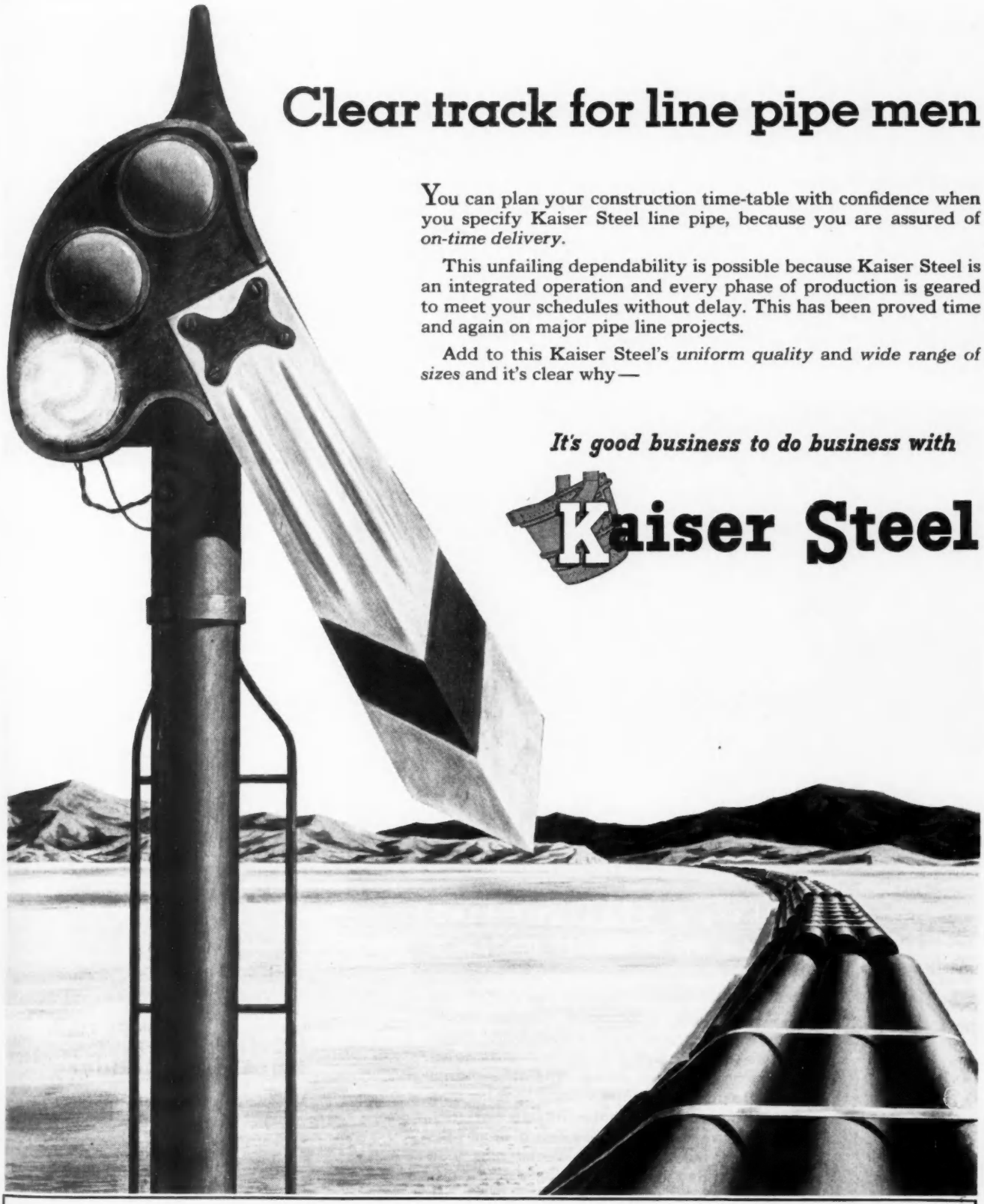


Lever Device Lifts Pipe Simply



PL-Lever on Wheels

Why sweat and strain to lift pipe off the ground to slip a chain around it or slide it on a dolly when a "lever on wheels" as illustrated can be made? When using the device to lift pipe, simply tilt the handle of the lever until the hook slips into the end of the pipe. The handle is long enough to give easy leverage. The two sections of the device are cut from ½-inch steel plate and wheels and short axles are tack-welded to the legs.



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Type	Diameter	Length	Wall Thickness	Shipping Point
Continuous Weld—Threaded and Coupled	½" to 4" nominal I.D.	Uniform 21'	Standard	Fontana, Calif.
Continuous Weld—Plain End	2⅜" to 4½" O.D.	Up to 40'	Standard	Fontana, Calif.
Electric Resistance and Fusion Weld—Plain End	8⅝" to 20" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser
Electric Resistance Weld—Plain End	5⅛" to 12¾" O.D.	Up to 55'	.188" to .375"	Fontana, Calif.
Electric Fusion Weld—Expanded—Plain End	22" to 30" O.D.	Up to 40'	.188" to .500"	Napa, Calif.—Basalt-Kaiser

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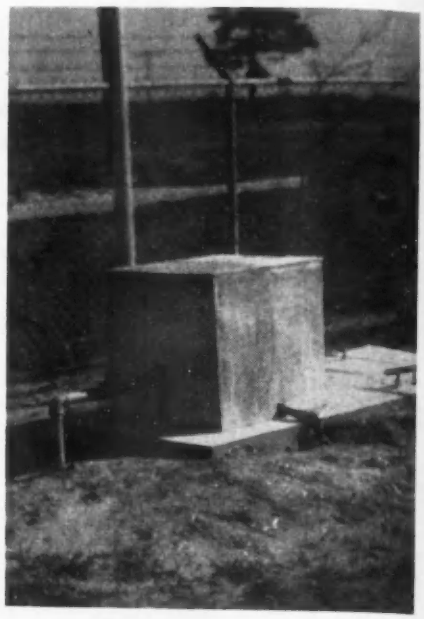
Metal Cover Protects Electrical Equipment

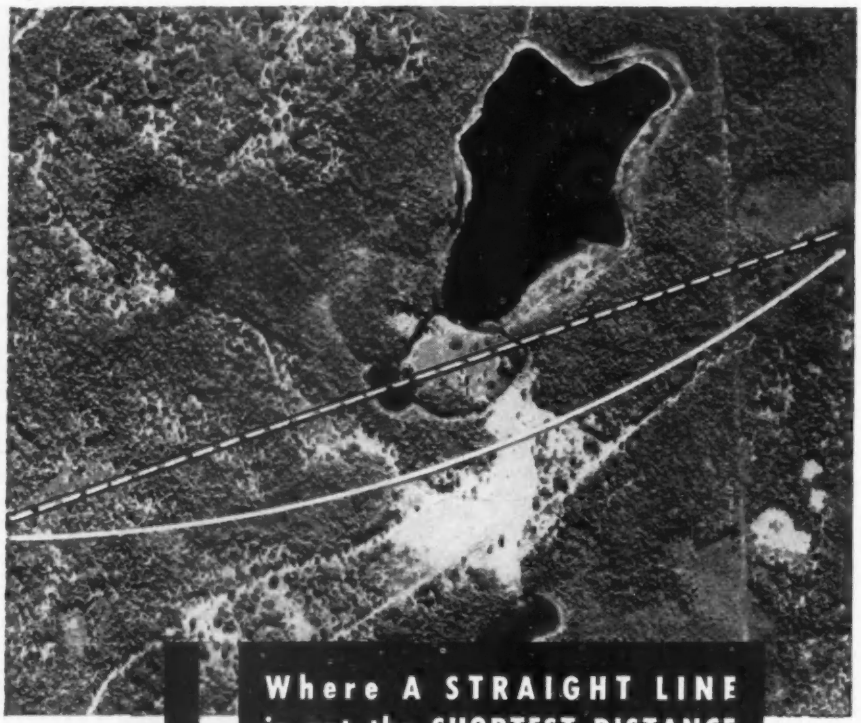
Occasionally electrical equipment must be used in a service for which it was not primarily designed. At one plant a sump pump and motor was sent in for a job which would place this equipment out in the weather as a permanent installation. Time did not permit securing a weatherproof motor for the pump so a cover was fabricated in the machine shop to protect the installation from moisture, dust and heat.

The cover was a three-foot square box built of 16-gauge galvanized sheet metal. Its top was curved slightly so rain would flow off freely. The corners of the box were reinforced with one-inch angles cut from the 16-gauge galvanized metal. Acid core solder and a heavy electric soldering iron were used to sweat the seams together. Notches were cut in the box so it would fit over the piping necessary to the operation of the pump and yet allow the cover to be removed for periodic inspection and maintenance.

On larger installations it is recommended that the box be reinforced



with one-inch angle iron and handles placed in accordance with individual taste. The installation shown has been in operation three months where rain has been commonplace. No ill effects have resulted on either the split-phase open motor or the open type solenoid switch which are housed within the box.



Section of an Abrams Aerial Mosaic: Scale 1"=1000'.

Where A STRAIGHT LINE is not the SHORTEST DISTANCE

On this aerial photograph the dotted line shows where a proposed pipeline would have been routed using conventional maps. The solid line shows the actual route based on an Abrams Aerial Mosaic. Aerial photography instantly showed that bending the line would eliminate crossing a stream, expensive resort property and a small lake —that, measured in time and money, a straight line here was not the shortest distance. Save your time and money; use Abrams Aerial Surveys to show you the shortest practical routes for your pipelines.

For complete information send for your copy of "Pipeline Planning from the Bird's-Eye View," and the brochure "Aerial Surveys and Maps from Photographs."

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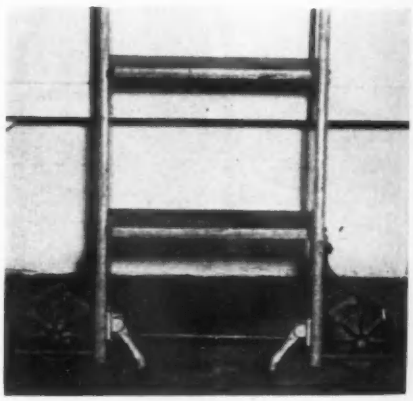

Doorstops Lessen Hazards of Ladder

You can screw ordinary doorstops on the bottom of a roll-away ladder and reduce its hazard.

For speed and convenience in handling materials, most warehouses are equipped with ladders that have wheel bases. This makes it easier for the warehouseman to shift the ladder from bend to bend; it also makes the ladder extremely dangerous to use. When the climber shifts his weight on the ladder, it has a tendency to roll.

If your warehouse is equipped with this style ladder, the danger can be

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REPUBLIC Electric Weld Line Pipe is formed from flat-rolled steel . . . the same thickness from side to side and end to end. The result is line pipe that is uniformly thick, uniformly concentric from end to end. *You* benefit because your crews can line-up ends quickly and welding crews can produce uniform weld beads at uniform speeds.

Clean surfaces inside and out provide freedom from holidays in protective coatings, prevent clogged valves and regulators caused by scale loosened after blowing-out the line.

Across the nation, more than 67,000 miles of Republic Electric Weld Line Pipe and 24 years service on many of these miles prove that Republic is the name to specify for pipe on transmission, gathering, products, and distribution lines.

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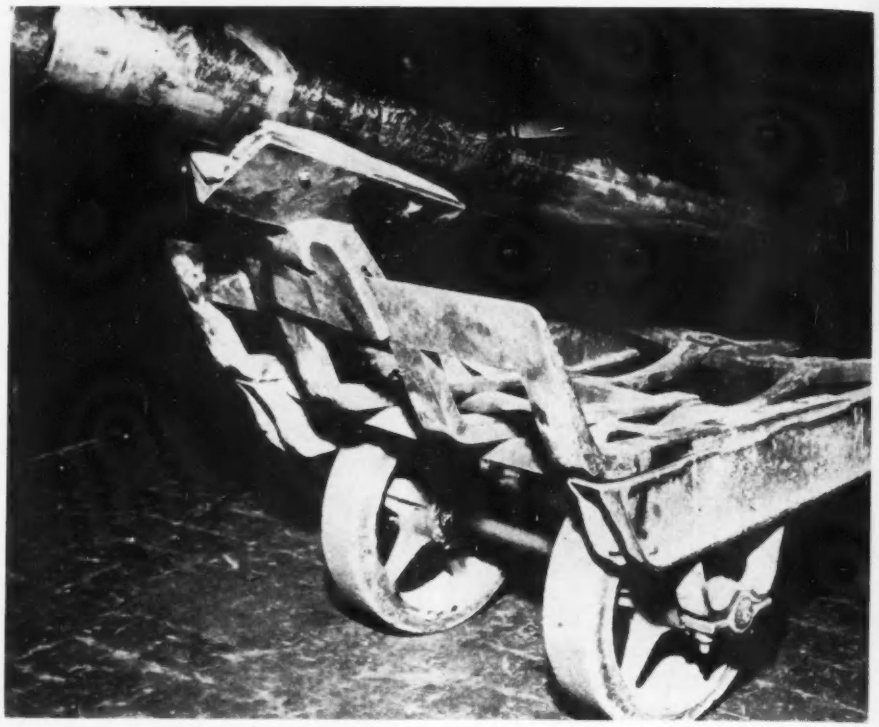
minimized by adding doorstops—the kind found in most offices—near the floor. The stops have rubber feet that squeeze into the floor to lock the ladder in place.

When the ladder is to be moved, snap the stops up with your foot, just as you do to close the office door. When the ladder is in position, you can snap the stops in place and make the ladder as safe as if it were bolted to the floor.



Cradle Device Aids Pipe Handling

Here is an attachment you can make in your welding shop that will simplify pipe and steel shaft handling. The device is a cradle which slips on and off the shoe of the truck with ease, yet holds the lengths of pipe or shaft in place while a man pushes the truck.

Nothing is harder than trying to balance a bar or heavy length of pipe on a hand truck. Usually a man has to walk alongside the truck and hold the piece in place. Not so with the device pictured. One man can flop the shaft or pipe over onto the truck and the self-aligning cradle lets it fall between the handles. Then one man can easily push the truck using both hands on the handles.

To make this handy attachment, weld two 4 by 10 pieces of three-eighths-inch steel plate together in such a way as to form a 90 degree angle. Then bolt a piece of hard rubber or truck tire inside the Vee you have formed and the cradle part of the attachment is complete.

Weld a piece of extra heavy one-inch pipe behind the Vee to form a hinge. Then fit the inside of the pipe with a snug pin and weld the pin to the wedge that holds the cradle to the truck. This wedge is made by welding two pieces of steel together, leaving a gap wide enough to fit onto the truck shoe. Thus, the attachment can be slipped onto the warehouse truck when it is needed, and removed just as quickly when you have finished using it.

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In FORT WORTH
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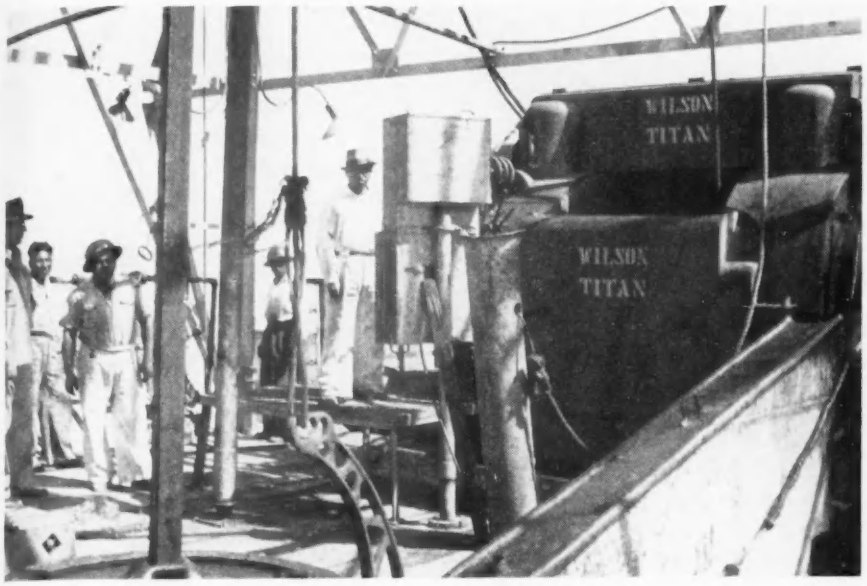
Come as you are . . . . . .



Rapid increase in drilling is expected to result from renewed leasing development in Peru stemming from the nation's new oil law. This is a view of a derrick floor of a well recently completed in Peru.

Peru Perks Up

Applications for concessions mount after new petroleum law eases restrictions.

By **DR. JUAN E. RASSMUSS,**
Petroleum Consultant, Lima

Part 1

PERU'S NEW OIL law has resulted in a spurt in applications for concessions under more relaxed government regulations and marks the first time Argentine capital has been used in developing new oil sources outside Argentina. Under this new law, domestic companies have priority in applying for concessions covering up to 10 percent of each of 11 designated blocks into which the coastal area of the Sechura desert has been divided.

Three new national companies were organized and applied on August 11, 1952, the date fixed by the government, for a total area of approximately 500,000 acres. Capital of the new companies amounts to slightly more than $2 million.

On October 28, according to the new law, Peru was opened to the entire private oil industry, domestic and foreign. Thirteen companies presented 252 applications simultaneously, covering about 9.3 million acres. About $1.5 million had been deposited as guaranties, in accordance with the law.

Although no drilling had been done in this area, an unexpectedly high number of direct exploitation concessions was requested, covering about 1.2 million acres, because they enjoy preference over exploration concessions when overlapping occurs. However, taxes are considerably higher, amounting to about $1.20 per acre for the first year.

Several American companies have applied for concessions, including:

International Petroleum Company, Ltd. (a subsidiary of Standard Oil Company of New Jersey) has sought the maximum of a million acres, including the maximum set on direct exploitation concessions of 250,000 acres.

Richmond Oil Company (Standard Oil Company of California) and Gulf Oil Corporation have applied for concessions similar to International Petroleum, though the latter concerns only exploration concessions.

Conorado Petroleum Corporation has requested about 865,000 acres, including 122,000 acres for direct exploitation.

Seaoil Ltd. of the Canadian holding group of Ventures Ltd. has applied for the maximum of a million acres, including the maximum set on exploitation concessions.

Peruvian Oils and Minerals Ltd., a Canadian group with capital of $38 million, 72,000 acres in Sechura.

Peruvian Oil Concessions, with $10 million of American and Argentine capital—almost 100,000 acres.

Compania Sudamericana de Petroleo, a recently-organized Argentine oil company in Peru—130,000 acres for direct exploitation. Thus, Argentine capital will be employed for the first time in development of new oil resources outside Argentina.

The recently-formed national **Petrolera Peruana S.A.** asked for a considerable number of exploration concessions, and the national **Cia. El Oriente,** the activities of which were formerly restricted to the Montaña, the Peruvian Amazon basin, also applied for concessions in the coastal area.

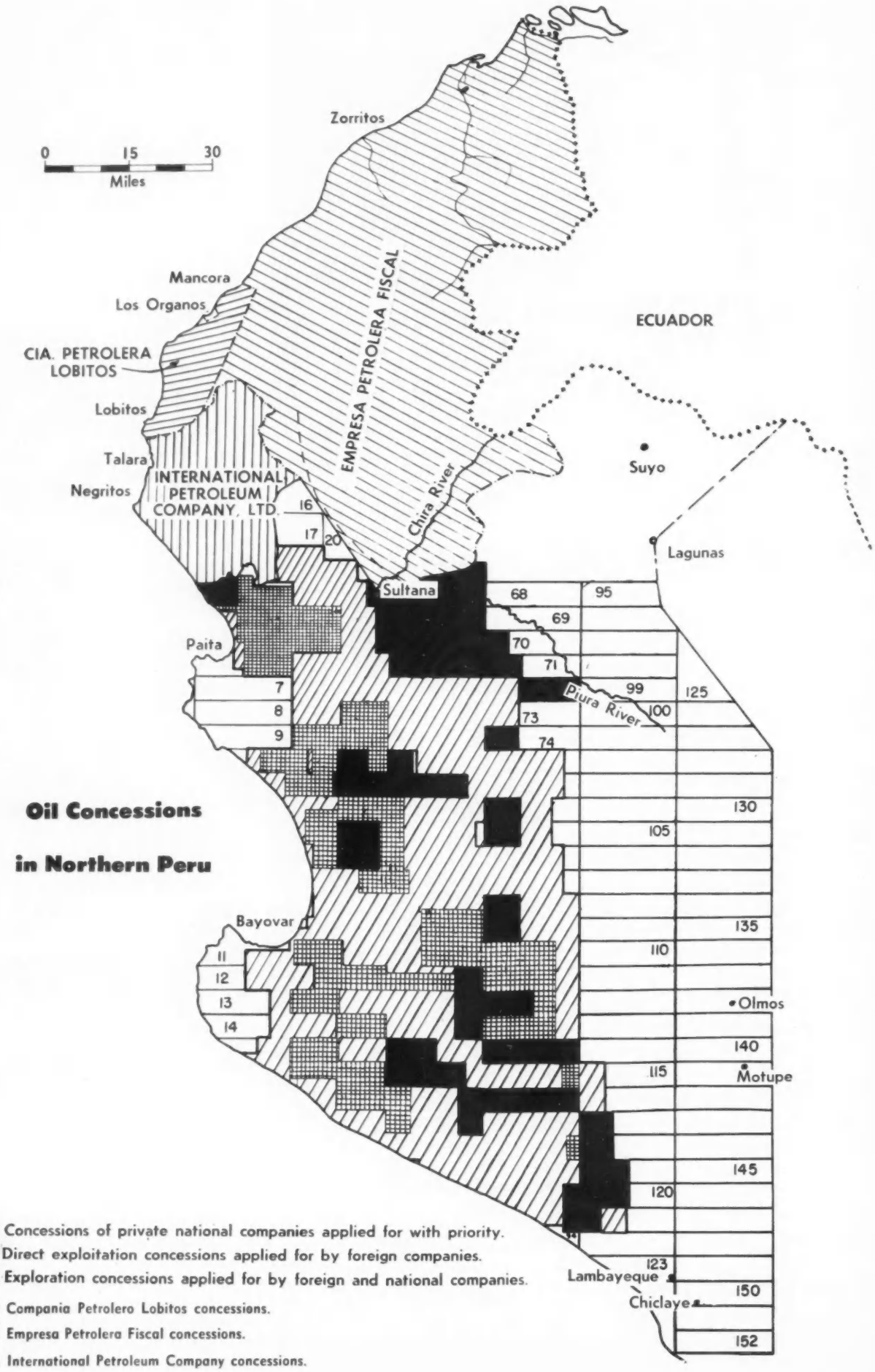
The known Peruvian banking and commercial firm of **Mrss. Wiese** also asked for an extension of its former small concession. Because of frequent overlapping of the concessions, domestic companies will have to compete in auction bidding against the stronger foreign companies. For that reason, priority for a limited area was given them.

Consorcio Minero, a Peruvian mining company, sought a concession in the Nazca region in the south, where no oil prospects are known.

Major oil companies, however, have not yet applied for concessions in the Montaña, which is the biggest oil prospecting area in the country. That has been due to the heavy necessary investments and minor urgency in view of the extensive available areas. But the domestic **Oriente Company,** which has drilled two exploration wells in that region, has applied for 1.7 million acres of new concessions.

Compania de Petroleo Ganso Azul, Ltda., also has asked for about 250,000 acres in various parts—from the Pachitea to Iquitos. **Canadian Oils and Minerals Ltd.** has taken 900,000 acres for exploration and 100,000 acres for direct exploitation in the Amazon region.

Current leasing activity in Peru is comparable only to the Canadian development. And only Venezuela surpasses Peru in South America in the number of newly-organized oil companies. Leases will amount to approximately $2 million for the first year, and the auction of the over-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Zorritos
Mancora
Los Organos
CIA. PETROLERA LOBITOS
Lobitos
Talara
Negritos
INTERNATIONAL PETROLEUM COMPANY, LTD.
EMPRESA PETROLERA FISCAL
Chira River
ECUADOR
Suyo
Lagunas
Sultana
Paita
Piura River
Bayovar
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Motupe
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Oil Concessions in Northern Peru
Concessions of private national companies applied for with priority.
Direct exploitation concessions applied for by foreign companies.
Exploration concessions applied for by foreign and national companies.
Compania Petrolero Lobitos concessions.
Empresa Petrolera Fiscal concessions.
International Petroleum Company concessions.

lapping areas is expected to reach an important figure.

Considering financial strength of the companies involved and the relatively short terms of from three years to five years for exploration concessions, active development is expected in the immediate future.

Ninety-nine percent of Peru's current crude output of 45,000 barrels a day comes from the coastal area, and one percent is provided by Ganso Azul in the Amazon basin east of the Andes mountains.

Two companies—IPC and the British Compania Petrolera Lobitos—produce the bulk of the nation's crude. But the proportionate production rate between these two companies has changed during the past three years.

International Petroleum's share has slipped because of its depleted field. Lobitos' yield has grown to about 25 percent of the country's total production. Empresa Petrolera Fiscal, which formerly supplied less than one percent of the total, has tripled its share.

Total crude production for 1952 can be estimated at 16.4 million barrels, with 1.05 million barrels of natural gasoline (see Table 1).

In all, IPC has drilled 4365 wells, of which 1885 oil and eight gas wells are currently in production. Three hundred wells are shut in. Modern techniques have guided field development and conservation.

Prospects. Peru's prospective coastal oil area includes about 7.5 million acres, of which approximately 5 million acres lie in the Sechura district, opened October 28 for private applications. Concessions held there by IPC and Lobitos cover about 500,000 acres.

In the northern area, between the Pacific coast and Amotape mountains, of about 2 million acres are situated two small oil fields belonging to EPF—Zorritos and Organos.

In the Montana, the Peruvian Amazon basin east of the Andes, the prospective oil area comprises more than 100 million acres. Gamso Azul holds concession rights to 75,000 acres in that area, and has requested about 3 million acres more under the new law. If the request is granted, renewed activity is expected in the Montana, although drilling requires considerable expense and effort due to natural conditions.

Two other oil prospects are on the border of Titicaca lake, where crude has been found in the Cretaceous. About 300,000 barrels has been recovered by shallow wells situated near seepages on a fault at Pirin. Thirteen government wells drilled several years ago were failures, however.

In the Ica region, near the coast south of Lima, Tertiary beds are exposed in broader extension, but the Tertiary sheet is too thin to justify any hopes.

About the Author

DR. J. E. RASSMUSS, independent geologist and petroleum consultant, studied in Germany and Switzerland, and he obtained his degree by a monography on the southern Alps. Under contract with the Argentine Government, he worked many years in that country, and later in Chile, Peru and Ecuador as independent consulting geologist. Returning to Europe, he became manager and member of the board of a Roumanian oil company until he was obliged to leave by the entrance of the Russians. He returned to Peru and became associated with the Peruvian government as petroleum consultant. Rassmuss has published many geological papers in Europe, Argentina and Peru and articles on South American oil.

TABLE 1

1952 Crude Production in Peru
(January-October)

Company	Barrels
IPC	9,472,048
Lobitos	2,800,401
Lobitos, Joint Operation A	930,620
Lobitos, Joint Operation B	7,288
Empresa Petrolera Fiscal	297,648
Ganso Azul	162,319
Total	13,670,324

1952 Natural Gasoline Production in Peru
(January-October)

IPC	758,189
Lobitos	120,447
Total	878,636

Geological Aspects. Peru's oil deposits lie in epicontinental areas of considerable sedimentary thickness along the northern coast on the Tertiary shelf of the ancient coast of the Amotape mountains and in the Montana on the eastern border of the Andean geosyncline against the Brazilian shield.

In the coastal area, the producing area lies in a Tertiary belt between the Amotape mountains and the Pacific and is only 15 to 20 miles wide. But the thickness of the sequence reaches 20,000 feet.

The Tertiary cover of the coastal plain is largest in the southern part, where the Eocene series is fully developed. It thins out in the north where Oligocene and Miocene rocks outcrop.

Below the Eocene, Cretaceous Malparo shale has been found in many IPC wells in La Brea-Parinas field. North of this field, the Cretaceous pinches out.

The Tertiary sequence is thinning out to the east to the Amotape shore line, where the facies changes to coarser littoral deposits. To the north are younger formations. East of Lobitos, Chacra, Talara, and Zorritos, the Oligocene Mancora sandstones cover older rocks of the eastern mountains.

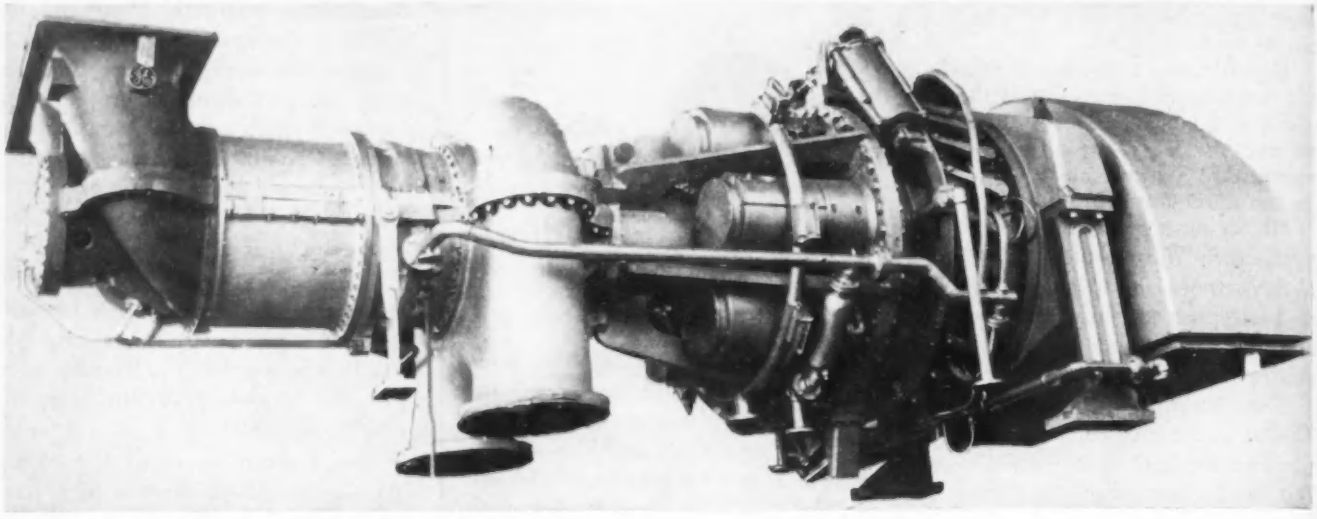
IPC has found oil in about 50 wells in Cretaceous Malparo shales, but total output has reached only about 150,000 barrels. Eocene oil must, therefore, be considered of primary origin. The almost exhausted oil in the Miocene sandstones of Zorritos is generally considered as secondary, having immigrated from Eocene beds.

Commercial oil accumulations are found on the anticlinal uplifts which are heavily broken into tilted blocks. Because of its tectonical position between the uplifted Amotape mountains in the east and the downbroken depth of the Pacific in the west, the narrow Tertiary belt is completely shattered.

However, because of frequent alternation of clays and shales, faults have been sealed and the oil preserved, although migration between the different Eocene sands may have occurred in many places.

In La Brea-Parinas field, the Pari-

(Continued on Page 280)



Ten gas turbine units similar to this one will be prime movers used to power specially-designed and constructed centrifugal compressors required by Creole Petroleum Corporation's Lake Maracaibo pressure maintenance program.

Giant Venezuela Pressure Maintenance Program Planned

Creole to erect unique plant in Lake Maracaibo in one of the largest gas injection operations ever undertaken.

CREOLE PETROLEUM CORPORATION is installing facilities to place one of its major Bolivar Coastal field reservoirs under pressure maintenance. This will be one of the largest gas return operations thus far undertaken for pressure maintenance of a single oil reservoir and the plant itself has a number of unique features. The field is located under Lake Maracaibo in Creole's Tia Juana District and the pressure maintenance plant will be built on a platform, seven miles from shore.

The reservoir involved consists of three fault segments in the B-6-X sand member of the Eocene formation. Since the faults do not form pressure or fluid barriers, the three segments actually constitute a single reservoir of approximately 9800 surface acres. The average net sand thickness is about 170 feet and the sand has excellent characteristics of porosity and permeability. The structure itself is a monocline with an average dip angle of about three degrees, pinching out up structure against a post Eocene unconformity. The reservoir is bounded on the side by faults and downstructure by an immobile water leg. The top of the sand is encountered at an average depth of 5250 feet.

Discovered in 1939. The reservoir was discovered in November 1939 by Creole with the drilling of well LL-370, from which the area derives its name. This well was a 3.1-mile step out, and was the discovery well for Eocene production in this portion of the Bolivar Coastal field. During 1940, only one additional well was drilled but full scale development of the reservoir began in 1941 when five wells were completed. Development continued at varying rates with 45 wells completed by the end of 1951.

The consolidated Eocene sand lends itself to comparatively high production rates and the average efficient per well rate is currently about 1200 barrels per day. Daily production from the reservoir has averaged close to 50,000 barrels per day since the beginning of 1946.

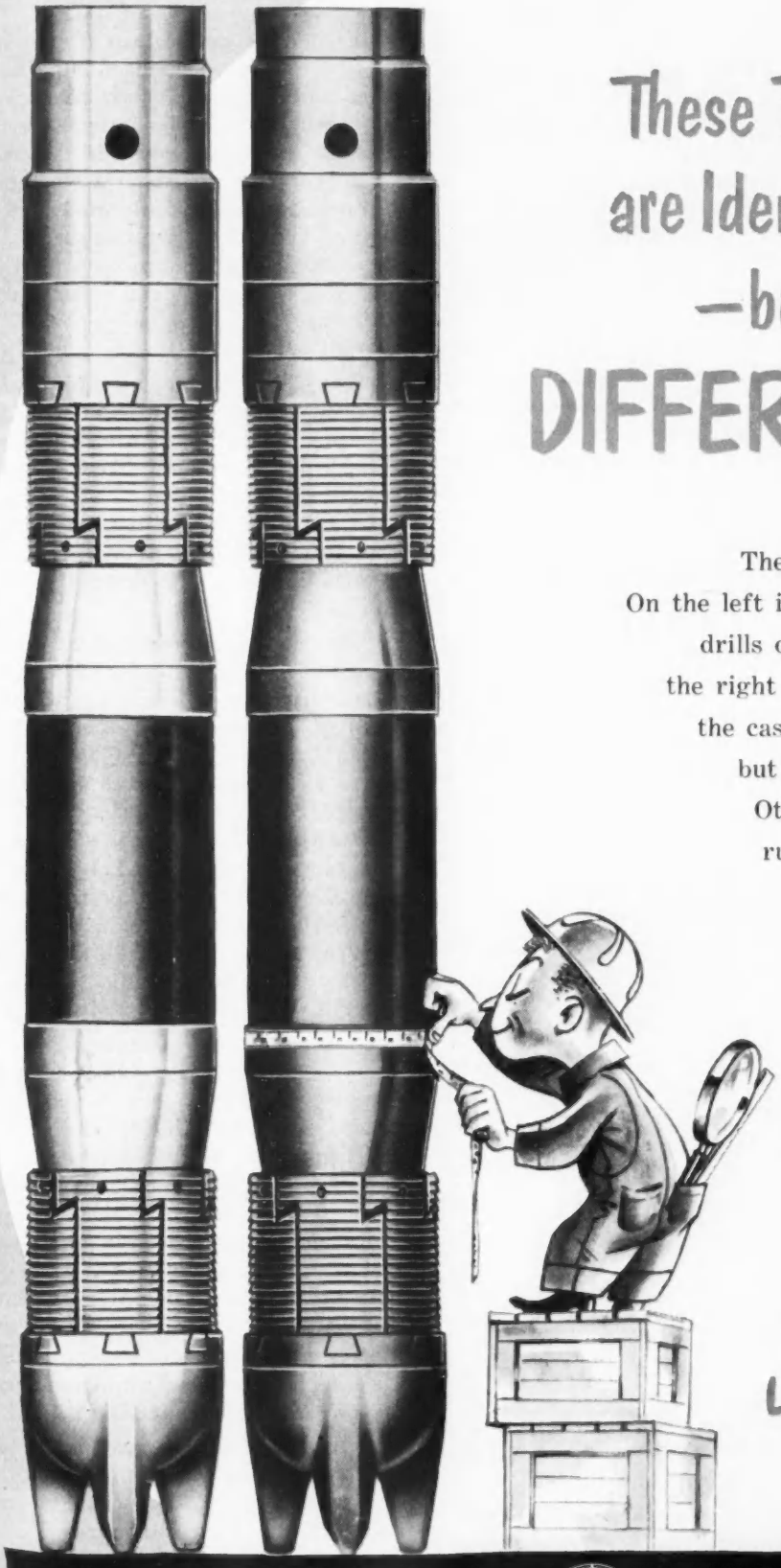
This reservoir is similar to practically all the other major reservoirs in the Bolivar Coastal field in that it has no edge water drive and originally had no gas cap. Production under normal depletion is obtained by a combination of solution gas drive, gravity drainage and secondary gas cap expansion.

The oil varies from a minimum of 18 gravity along the downstructure limits to a maximum of 28 gravity at the crest, the average gravity being 25. This crude is about average in quality and characteristics for the Bolivar Coastal field but is somewhat lower in gravity and higher in viscosity than most crudes found in the U. S.

Original reservoir pressure at 5235 feet sub-sea was 2590 pounds per square inch and although the field has had no water influx, the pressure had only declined to 1740 pounds per square inch at the end of 1951, at which time the cumulative production was 144 million barrels. This efficient utilization of energy has been made possible by adhering to a voluntary policy of strict gas-oil ratio control.

During development of this B-6-X reservoir, the importance of obtaining core data and subsurface samples was fully realized and a number of wells were cored through the entire section. Porosity, permeability and saturation characteristics were determined for all parts of the reservoir and the subsurface sampling program, which was carried out along with the development program, provided a complete set of data on the varying oil characteristics.

Correlation and analysis of these data were the first steps in a comprehensive reservoir analysis started by Creole about four years ago. Largely as a result of the complications introduced by varying rock and oil properties, the job of accurately calculating



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The difference lies in the material. On the left is a MAGNESIUM Plug, which drills out in 1 to 3 hours: the one on the right is cast iron, which will outlast the casing on permanent installations, but still drills out in 4 to 6 hours. Otherwise, they're identical. Both run fast through fluid, set easily and quickly right where you want them, and give *positive, leakproof packoff* against high differential pressures.

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recoveries under various possible methods of operation required approximately ten man years of work. The comparison of predicted reservoir performance under natural depletion, pressure maintenance by gas injection and pressure maintenance by water injection indicated that the gas injection method of pressure maintenance would be most advantageous.

As a result of the analysis, it was decided to build a pressure maintenance system capable of injecting 130 million cubic feet of gas per day. This will give complete pressure maintenance by full volumetric replacement of anticipated future reservoir withdrawals.

Big Problem. The fact that the plant will be built on a platform in 62 feet of water made compressor and engine vibration a serious problem. This consideration in addition to favorable economics, led to the selection of an all-centrifugal installation. The plant will normally inject gas at an estimated well head pressure of 1935 pounds per square inch and must be capable of developing over 2000 pounds per square inch pressure at the compressor discharge manifold.

Since no centrifugal compressor had thus far been built to develop more than 1000 pounds discharge pressure, it was necessary to design one which would do so. This job was begun, and ten compressor units are being built which will provide the seven stages of compression. The first stage will have three units in parallel, the second stage two units in parallel and the third, fourth, fifth, sixth and seventh stages will be performed by one unit each.

It now appears that the plant will have a normal capacity of one unit each, that the plant will have a normal capacity of 137 Mmcf. per day, or 7 Mmcf. more than originally called for. Each of the ten compressors will be driven by a 5000 horsepower gas turbine. While gas turbines of this type have been in operation for some time, the LL-370 plant will be the largest industrial concentration of gas turbine horsepower thus far built. The turbines will use gas for fuel, taking supply from the second stage compressors.

Brown and Root Incorporated of Houston was selected to do the engineering design work and construct the plant. Casting of the concrete piles for the plant platform has already started and driving will begin early in 1953. If nothing interferes with equipment delivery schedules, the entire plant should be completed and in operation by the middle of 1954.

Gas for this pressure maintenance project will be gathered from eight Creole flow stations, located in the general vicinity of the compressor plant. Since the flow stations must be operated at very low pressures, some of the gas gathering lines will be as much as 30 inches in diameter. The designing and laying of such a large diameter gathering system on the bottom of Lake Maracaibo constitute a major engineering problem in itself. Of interest is the fact that in addition to weighting the lines to keep from floating, means must be provided to empty them in case of leakage, since water pressure on the outside will be greater than the gas pressure within and any line failures will result in flooding rather than in escape of gas.

In order to determine the path and rate of advance of the injected gas, a carbon monoxide tracer system is being provided. Periodic tests on producing wells to detect the presence of the tracer material will enable the reservoir engineers to check the displacement efficiency and control the advance of the secondary gas cap.

The natural gasoline will be condensed in the interstage coolers and will be removed by scrubbers and put through a stabilizer. From the stabilizer it will be pumped to one of the nearby flow stations and put into the crude stream. No gasoline storage facilities are to be provided on the platform.

The benefits anticipated from the project are of such an order as to make it very attractive, both to Creole and the Venezuelan nation. It is calculated that in addition to furnishing a 33 percent increase in ultimate recovery over that obtainable by natural depletion, pressure maintenance by gas injection will increase the maximum efficient production rate of the reservoir almost 50 percent. The need for artificial lift equipment will be eliminated and by choosing gas as the injection medium, the wet oil handling and treating problem will be avoided. Finally, from a conservation standpoint as well as from the economic view, the injection and storage of 137 Mmcf. of gas per day for future use will be a major accomplishment.

Peru Perks Up

■ CONTINUED FROM PAGE 277

nas sandstone yields about 70 percent of the total production and the biggest wells, some of which have produced about 2 million barrels each. But the sandstone, which in the central field contains about 80 percent oil-bearing sands, thins out to the north. North of Organos, in the Mancora region, it disappears, and it pinches out to the east against the Amotape mountains.

Of secondary importance is the underlying Salvinas sandstone of Lower Eocene, which produces less than 20 percent of La Brea-Parinas production. Pale Greda sands, likewise, yield substantial production. The Verdun of the Upper Eocene is third in importance. Talara sandstones have afforded less than one percent of the total.

Of current interest to many oil companies is the Sechura desert, in the Department of Piura, south of the current producing area. The coastal plain broadens south of the Chira river to a width of about 60 miles. A wide Tertiary embayment lies between remnants of the old Coast Range, preserved in the Lobos island, the Illescis mountains and the Cerros de la Silla de Paita in the west, and in the eastern border of the Andes to the east.

The embayment is covered by marine Quaternary deposits and alluvial sands and gravels. Possibility of a full development of the Tertiary sequence makes this area a highly prospective oil region. Interest is drawn to the area because of the probably less disturbed structures, remarkable oil seepages and sulphur deposits produced by oil and gas emanations through Tertiary gypsum beds on the western border of the Tertiary sequence. Too, the possibility of Cretaceous oil-bearing limestones, which outcrop east of the Amotape mountains, is good.

There is a strong possibility that the offshore marine shelf will prove productive. Oil patches on the sea, west of the Illescis mountains, and oil and gas emanations on the border fault to the Pacific escarpment west of Lobos de Afuera island are strong indications that the offshore marine shelf will prove productive.

(First of Two Parts)

Explorers at Work ...

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Australia is beating the bushes for oil

Caltex and Ampol take the nation's most recent exploration effort deep into the heart of the land of thirst, starvation and sudden death.

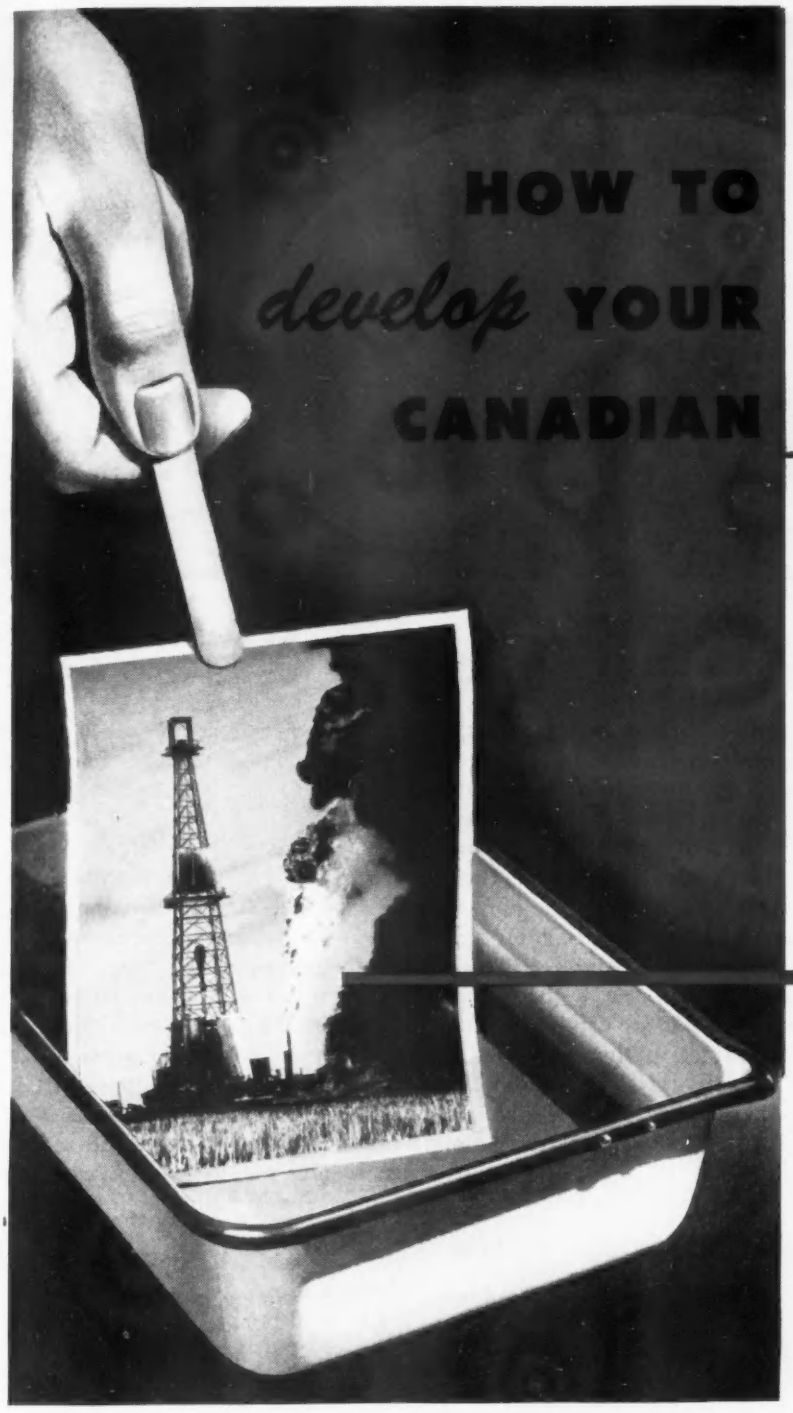
By J. LLOYD MARSHALL

THOUGH AUSTRALIA has not one productive oil well, Western Australians are no strangers to oil men. For more than a half century they've come and gone. Always there have been guarded answers to questions. "There might be . . . and, of course there might not be . . ."

The location of the most recent exploratory effort is real rough bush country. In it men have died of thirst, starved and been speared to death. The nearest city of any size is 600 miles away. Social and business communications between individuals and stations are appalling by U. S. standards. Yet when you think that a population of 600,000 spread over an area about one-third the size of the U. S. has made even those communications, the realization is staggering.

This is the type country which West Australian Petroleum Pty. Limited is surveying to drill its exploratory wells. For the most part the surface may be described as much the same "wildcat" area as the subsurface. Caltex Oil (Australia) Pty. Limited and Australia's Ampol Petroleum Limited are associated in this joint venture, referred to as WAPET, and have a concession area of some 340,000 square miles, which extends along the northern coast and inland almost to the eastern boundary of western Australia and thence down the western coast to the southwest tip of Australia. The northern part of the concession extends deep into the great desert tableland.

There are five large river basins included in the concession area. The results of surface mapping and stratigraphic studies conducted by the Australian Bureau of Mineral Resources, Geology and Geophysics established a total thickness of 11,000 feet of Permian sediments in the



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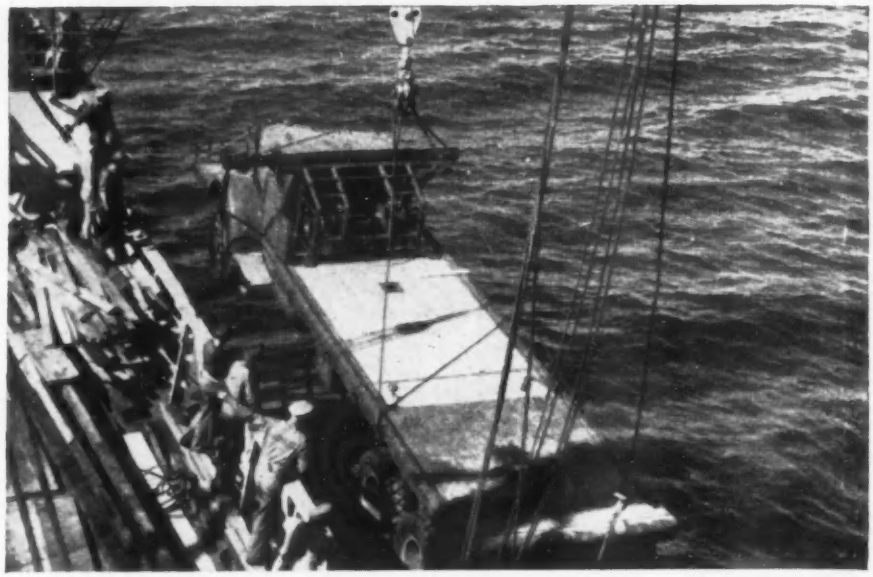
Northwest Basin. Temporary landlocked conditions of the basin are indicated by black shales with a small proportion of evaporites. About 9000 feet of Devonian and Carboniferous marine sediments resting on the pre-Cambrian basement underlies the Permian along the eastern margin of the basin.

In the coastal areas, Paleozoic rocks are overlapped by several hundred feet of marine Cretaceous and Tertiary sediments. It is in the latter area, in the vicinity of Learmonth on the Exmouth Gulf, that WAPET decided to break into the bush country. Before the first rig could be assembled on location, however, the best know-how and ingenuity of WAPET had to be called on to move equipment some 15,000 miles from the U. S. and put it ashore. There is no harbor and there are no lateral roads inland.



Truck is lifted onto landing barge for trip to the anchored Danish freighter Ellen Maersk. Cargo was then loaded directly onto the truck.

With miles of shallow waters which require anchoring offshore and moving equipment to the beach amphibious style, and a nine-foot tide with which to reckon, 2100 deadweight tons of the most awkward cargo a ship's skipper could dream about were landed. The operation is believed to have been the biggest non-military amphibious operation ever conducted in Australia.

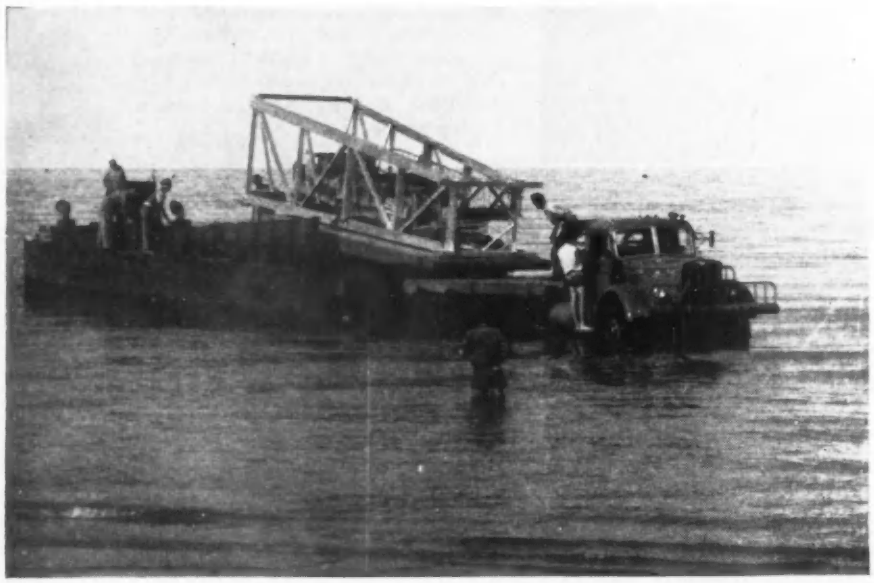
The Danish freighter Ellen Maersk was used for the job. On its 15,000-mile trip from the U. S. the freighter carried three wartime landing craft. A naval flat top lighter was towed 800 miles from Fremantle by a State freighter. The landing barges were sent ashore empty from the freighter's anchorage. Heavy duty trucks were picked up by the barges, transported back to the freighter and then cargoes were loaded directly onto the trucks. Once back to the beach, the cargoes could be driven directly from the barges to the layout point two miles away on the aprons of a retained Air Force landing strip. It was always a race against time and tide. At times, heavy diesel trucks with loads up to 25 tons had to be driven into the sea as far as 100 yards offshore.

There was nothing left to chance. A welding crew was constantly on duty on the beach. If a craft was holed—and it happened occasionally on the rubble—low tide saw the welder at work burning on a patch ready for the next flood tide.

While loading alongside the freighter, one barge skipper noticed his barge going down. He was faced with the loss of a barge and a diesel truck. This may be considered "small change" back stateside in Los Angeles, but pure gold 15,000 miles away on the isolated Exmouth Gulf. He shot top speed for the beach and made it although he had more than three feet of water sloshing around the truck.

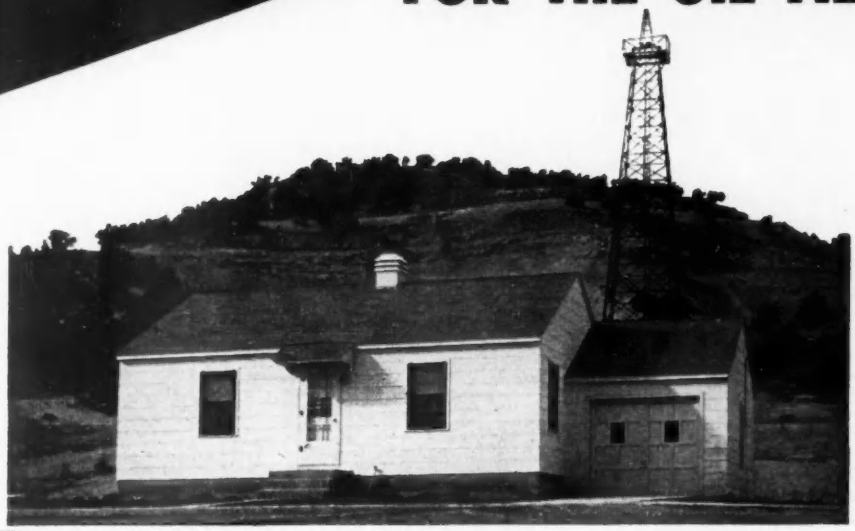
An average work day lasted 12 hours. An average days unloading landed 150 tons of cargo on the Learmonth apron. The best day's work was 183 tons.

Western Australians are accustomed to the difficulties associated with the north. (Exmouth Gulf is not even fully surveyed yet.) To people who successfully have overcome the obstacles of the north and made their homes there, the Australians give credit. The hardy members of WAPET project, came, saw what they were up against and still decided to press on.



Here the loaded truck pulls off into water for trip to shore. Tides at times prevented the barges from getting closer than 100 yards to the beach.

WHY STURDYBILT PREFABRICATED HOUSES FOR THE OIL FIELDS?



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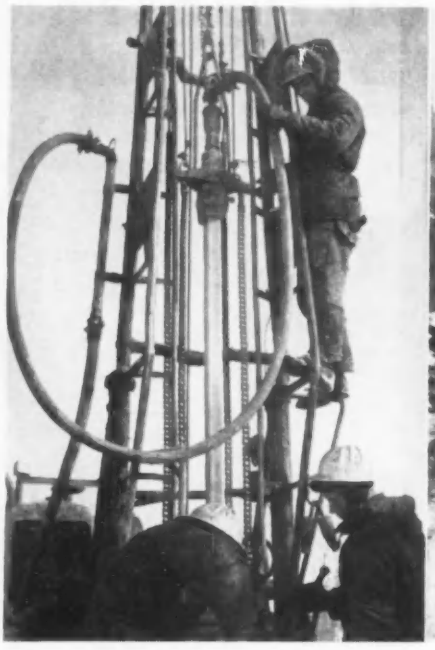
The seismograph goes North

No. 4

This is the fourth and last in a series of articles describing the movement north of seismograph exploration in the continuing effort to discover oil beneath the Arctic muskeg.



Drillers are oftentimes ice-caked.

Flag marks shot hole site in snow-covered ground.

Shooter and helper ram dynamite into hole.

Br-r-r-rother, It's Cold Outside!

But nobody's told the seismograph crews in Canada's muskegs. Minus-30 degree weather doesn't slow them down.

Water is where you find it. Here it comes from frozen river.

Trailside caches of fuel keep operations going in far north.

By **JAMES JOSEPH**
Bureau Chief, Western Round-up,
Los Angeles

A seismograph blast shakes the frozen muskeg.

AFTER EXTENSIVE cold weather maneuvers at its Big Delta bivouac near Fairbanks, Alaska, the U. S. Army recently came to the conclusion that generally a man loses two degrees of efficiency for every degree below zero. By this rule of thumb, a man is only 40 percent efficient when the mercury drops to —30. At —50° F., he spends all his time just staying alive.

Fortunately, the army's findings haven't yet reached seismograph crews in Canada's muskegs, 600 miles north of Edmonton. They've worked two winters now through weeks of —30 degree weather without drastic reductions in the number of shot holes drilled and shot.

One party chief heard the army's new theory and exclaimed, "For gosh sakes, don't go spreading rumors like that around here. You want the men feeling sorry for themselves!"

One reason, at least, why the 63-odd seismograph crews which worked the muskegs the past winter kept their efficiency up was that, operationally, they'd prepared for the weather.

Only two seismographic components had to be winterized: men and machinery. Surprisingly, crews found it somewhat easier to acclimate themselves than to winterize their machinery.

Yet, they managed to balance the old equation of winter versus men and machinery by some new methods.

One crew pretty thoroughly redesigned its 400-gallon water trucks which bring water to shot holes for the drilling operation. At —30 to —50 degrees, water froze in the tankers. So seismographic crews designed a self-heating unit.

Two methods were employed: one kept the tank's water lukewarm and above freezing. The other warmed the various valves and pipes feeding water to the drill holes.

One 400-gallon, track-mounted vehicle was built with a fire box and short-stack pipe chimney running through the water tank. Firewood and brush were stuffed into the six-inch diameter pipe which ran through the tank. A fire was used during the coldest weather. Yet even this was insufficient, so a secondary heating system was installed. This had the dual purpose of warming not only the tank but also associated valves and pipes.

The vehicle's engine exhaust was routed through 50 feet of two-inch pipe coiled in the tank's bottom, and finally exiting near the outlet valve from which water was carried by hose to the shot hole. This same hot pipe thawed controls on the tank's vacuum pump, various valves and other controls. It worked.

This is one example of field ingenuity in the face of sub-zero temperatures.

In usual winter field operations, each seismograph crew is divided into several units. Road-dozing tractor crews are usually separate from the seismologists—and are usually found working miles ahead of the drillers. There are two types of surveying crews. One works with the bulldozers, laying out roads. In a few cases, cat-skinners have built roads a full year ahead of the seismographic crews.

Working in harmony with the seismograph crew is a second surveyor. He and his rodsman locate shot holes every 1100-feet, marking them with a colored streamer. With a different colored streamer, the surveyor crews likewise locate the position of the recording unit, so that every shot records an "overlay"—that is, a total of 2200-feet, 1100-feet on either side of the recorder.

Behind surveyors are the drillers,

Crew chief scans wet seismograph chart.

Geophone being placed in Arctic snow.

working with one or two water wagons. Surveyors work a day ahead of drillers; drillers a day ahead of the shooters. Shooters, recorders and "jug hustlers" work as a single operational unit. And in the northern muskegs, each group is independent and usually self sufficient.

Toughest job in cold weather belongs to the drillers, who are sometimes sprayed with mud and water, and sheathed in ice. Their rigs are also iced. When temperatures drop to 30 degrees below zero, two hours may be required to drill and prepare a single shot hole. Reason, of course, is the freezing of equipment, since a lot of water is used for the job.

A kindred cold weather hazard, especially associated with drilling equipment, is crystallization. Stress points take a beating. The kelly swivel is especially susceptible to breakage. Also, if the kelly swivel freezes, the stem may unscrew itself and drop the swivel hose. That's why flame throwers are used to heat the pull-down chain and the kelly swivel before each drilling operation.

A safety chain, attached to the swivel, has prevented many injuries. Even in the coldest weather, safety helmets are worn over parka hoods. Drilling is slow going in very cold weather because all piping must be drained before moving on to the next hole.

To make the shot count, shot holes must be drilled below the first layer of weathering—that is, into the permanently frozen ground or into solid ground. This means a minimum 15-20-foot hole, with depths sometimes going to 40 feet.

Water Scarce

Scarcity of water delays drilling. This seems ironic, since the ground is covered with snow. But the many rivers cutting the muskegs are seldom near the drilling crew and the 400-gallon supply tanker. Tanker drivers pretty well have to find their own water.

Usually a tanker driver locates a river as close to the drilling as possible, cuts a hole in the ice, and stirs the water after each withdrawal so the hole won't freeze before he returns. Almost all water for camp use is drawn from these same ice holes.

The water shortage—and its usual considerable distance from drilling operations—poses another problem. Water is necessary to the drilling, but trucks are often gone an hour or more in refilling. This would mean a shutdown in drilling. But field crews avoid this delay by carrying an auxiliary (usually 150-gallon) water tank on the drilling rigs.

Here again, the drilling rig's exhaust warms the tank. One drilling rig ran a flexible hose over the auxiliary tank via a metal-covered "warming box" built atop the tank. Exhaust heat was also routed to valves and piping on the tank.

While native Indians, working with the seismologists, have learned a lot of oil lore, the Canadian-American crewmen have also learned from the Indians. Most crewmen have switched from boots to moccasins and mukluks, with perhaps a rubber boot over that. Some wear as many as three pairs of moccasins under mukluks—and forget the rubber overshoe.

One Crew Has it Easy

The recording crew has the easiest time of it during the winter, for their "dog house," in the rear of the recording truck, is heated. And they aren't often called upon to venture outside.

It's a different story with summer operations. Some crews use all-track equipment in an attempt to be "mobile" in the boggy muskeg during the summer. But the summer of 1951 was a nightmare to many a crew.

Drillers dug their shot holes by hand, using post-hole diggers. Everyone packed his own equipment—on his back. The shooters lugged 50 pounds of dynamite, and the helpers followed a safe distance behind with the caps. During 1951 summer operations, recorders back-packed 60-pounds of portable, clumsy batteries; they wallowed and fell in the muskeg, since they were made top-heavy by the recording cameras and other electronic gear strapped to their backs. The average recorder's load weighed 60 pounds.

After working a 12 hour day, most crewmen are ready to head back to camp. But in cold weather trucks and track equipment are left near the last shooting site, huddled together in a kind of bivouac—and watched over by one crew member assigned to stay up and keep the motors from freezing. Motors are run alternately 15-30 minutes every two hours. Unhappily this means that fuel tanks run low, and since extreme nighttime lows mean condensation in fuel lines, the night man must constantly fill tanks, drawing gasoline from 10- and 55-gallon drums.

All through the muskegs various oil company seismograph crews have caches of gasoline. Around almost every turn in the bulldozed, muskeg road you find these caches, usually three or four 500-gallon tanks.

Seismologists generally agree that raw cold itself—even the worst of it—doesn't cause breakdowns. They say that vehicular flaws (especially axles, springs, shocks, etc.) were already present in the metal, and that cold merely accentuated the weakness.

The thermostatically-controlled six-volt heating element to warm the recording camera's developing chemicals to 68 degrees has been found essential. Fortunately, chemical temperature is not critical, and a few degrees either side of this figure is satisfactory. Most crews run an extension of the windshield's defrost hose to the recorder's ten six-volt batteries because cold batteries lose as much as 50 percent of their efficiency. The recording truck or track vehicle is usually kept warm (its motor running) all night in extreme temperatures to keep batteries from freezing.

And as for the profiles, one field boss said "muskeg can play hob with seismographic patterns. All shots are filtered because of objectionable muskeg resonance." Another trouble is that muskeg, which often doesn't freeze solid if an insulating snow covers it before the first big freeze-up, "damps" the shock-waves. Often, very little energy is returned from a shot.

That is one reason why some field operations are predicated on a three shot per hole recording. Many holes shot by the crews have had to be reshot when the developed film showed unsatisfactory energy return.

Weather Treatment

As for general winterizing, everything from nuts and bolts to fire extinguishers get special weather treatment. Nitrogen is added to the extinguishers, for example, to prevent freezing. And moisture absorbing chemicals are added to each vehicle's gasoline tank, in an effort to minimize condensation.

With water scarce both in the field and in camp, one crew installed tin wash basins when they could have put in running water. "The guys don't use as much water that way," explained a water-thrifty camp attendant.

"But winter in the muskegs," agree most crewmen, "isn't half as bad as summer. At least there aren't any mosquitoes. Operationally we'd rather have —30 degree temperatures than mud—mud—mud."

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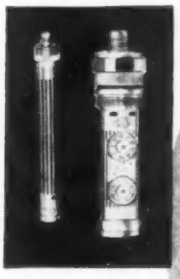

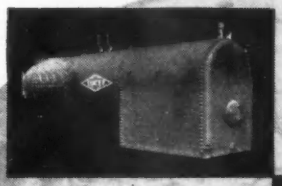

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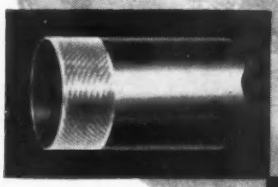

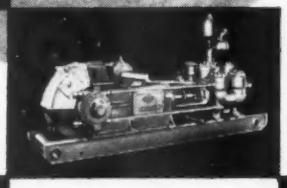

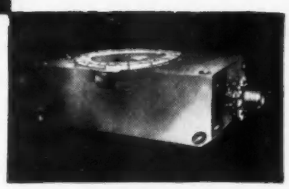

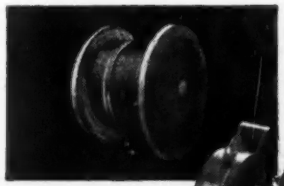

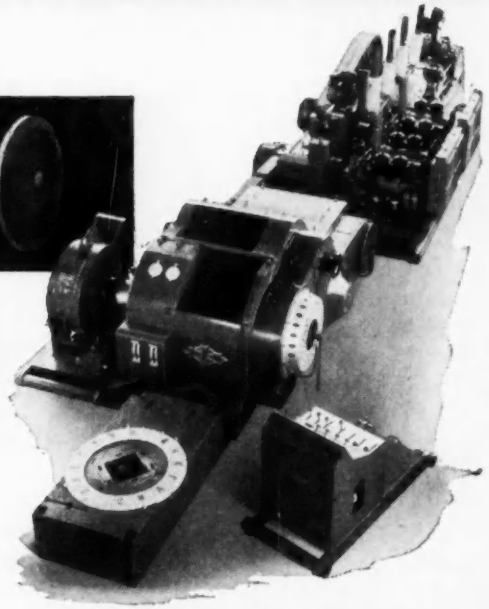

FIGURE 1
Index map showing location and regional geologic and geographic setting of the Yakataga and Katalla Districts of Alaska.

Search for Oil Pushed In the Land of Icebergs

Phillips Petroleum Company to explore Alaskan area in territory's first major privately-owned effort.

A NEW SEARCH for oil in Alaska will begin as a result of the recently concluded negotiations between Phillips Petroleum Company and the U. S. Department of Interior. The exploration agreement covers approximately one million acres in the Yakataga and Katalla districts on the extreme southern coast of Alaska on the Gulf of Alaska.

The location of the area (see Figure 1) to be explored by Phillips is diagonally across the territory from the Naval Petroleum Reserve No. 4 which totals some 37,000 square miles in the extreme northern part of Alaska. Phillips' contract requires it to drill 12 exploratory wells, six in each district, over a ten-year period. The company has agreed to spend $1.2 million and to commence two wells prior to June 30, 1956, and a sum equivalent to 40 cents an acre annually thereafter.

Previous exploration for petroleum has been carried out in both districts and one oil field has been found in the Katalla district. The U. S. Geological Survey has conducted continuous investigations of the area and its most recent detailed report was on the Yakataga district by Don J. Miller and published by U. S. Department of Interior in 1951. The geological data contained in this article is digested from that study.

Early Activity. Numerous seepages of oil and gas in the Tertiary rocks of the Yakataga and Katalla districts were discovered before 1900, attracting exploration efforts which were concentrated mainly in the Katalla district. The Katalla oil field was discovered in 1902, and from then until 1932 produced about 154,000 barrels of high-gravity, paraffin-base oil from 18 shallow wells.

Only one oil test previously has been drilled in the Yakataga district. It was an unsuccessful well, Sullivan 1, drilled in 1926-27 by General Petroleum Corporation. It was drilled to a depth of about 2000 feet on a large oil seepage on Johnston Creek atop what is now traced as the Sullivan fault in southern Yakataga. While no oil was reported, the well had showings of gas.

Nearly all the known oil seeps in the district are in a belt extending 18 miles along the coast and as much as two miles inland, between Cape Yakataga and Johnston Creek. About 25 separate oil seeps were noted in this belt during the 1947-48 field investigation of the Geological Survey.

More than half of the known oil seeps in the coastal belt area are located on or near the Sullivan fault. The position of this structure has been approximately traced as extending about 20 miles along the coast westward from Icy Bay and from one to one and one-half miles inland. The seepages south of the Sullivan fault, nearer the coast, are located on or near minor faults or sheer zones in the rocks of the Yakataga formation.

The seepages north of the Sullivan fault are located on part of the Poul

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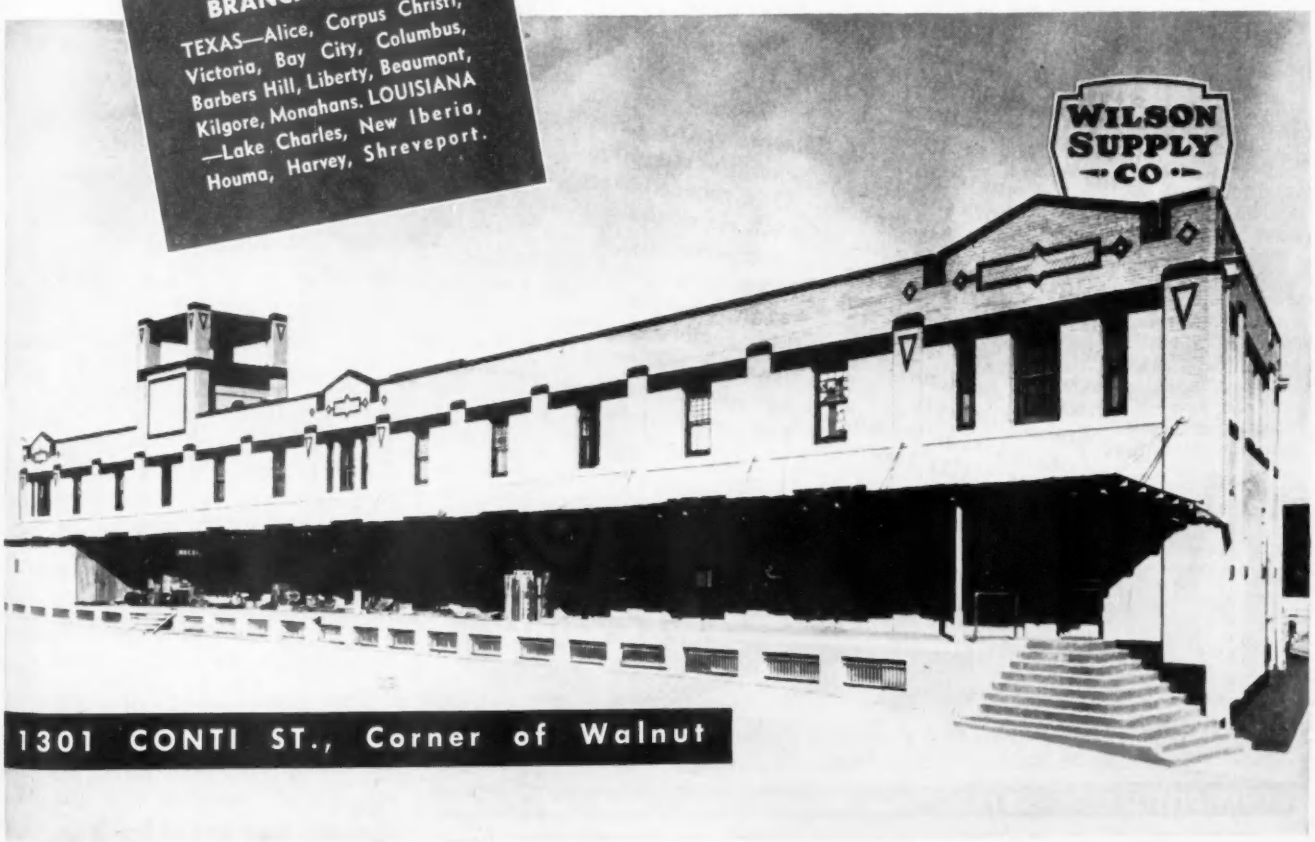

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Creek formation and at the base of the overlaying Yakataga. At the large seepage on the site of the abandoned Sullivan 1 well on Johnston creek, oil accumulates in small pools of water some distance south of the probable location of the Sullivan fault. The oil may issue from this fault or a minor fault branching from it.

Distribution of the known seepages in the Yakataga district, with respect to stratigraphic and structural features, suggests that the petroliferous rocks giving rise to the oil are in the Poul Creek formation and possibly the lower part of the Yakataga. This is believed true because about 70 percent of the seepages are located on outcrops of the Poul Creek formation or on faults along with the Poul Creek forms either the hanging or foot wall; most of the remaining seeps are located on outcrops of the lower part of the Yakataga, and no seeps or other indications of oil have been observed in the Yakataga district from beds definitely known to be pre-Poul Creek in age.

Green Oil. Oil found in a typical seep in the Yakataga district is light green in color and is similar in appearance to the oil in seepages in the Katalla field area. The volume of oil issuing in most seeps is very small, but the flow at the large seepage at Johnston Creek has been estimated at the rate of a barrel a day.

Much of the sandstone in the exposed Tertiary strata in the Yakataga district is poorly sorted, containing a large proportion of silt- and clay-size grains that fill the interstices between the sand grains, and therefore is low in porosity and permeability. The sandstone in the lower Teritary sequence appears to be uniformly hard and tight, but some of the sandstone in the Yakataga formation and in the Poul Creek formation near the coast seems to be fairly porous and permeable, and may provide suitable reservoirs for the accumulation of oil.

The largest and well-defined upfolds in the southern structural belt, the coastal upfold, and the Yakataga anticline are not the type structures generally regarded as being favorable

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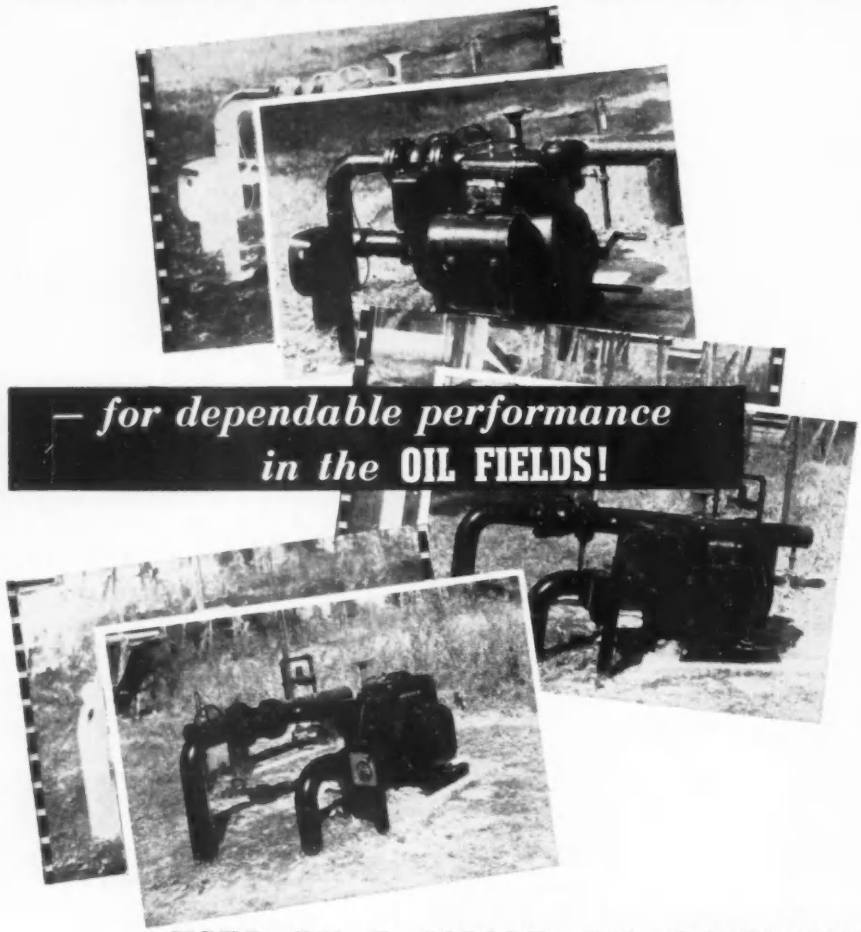

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for trapping significant accumulations of oil. However, some of the anticlines exposed in the Guyot and Karr Hills are fairly open at the present erosion level, and probably bring the Poul Creek formation to within reasonable drilling depth. It would be extremely difficult to get drilling equipment into the area though, according to Geological Survey report.

The report recommends that on the basis of information available, considering the known geologic factors and the accessibility of prospective drilling sites, locations on the Yakataga anticline in the vicinity of Porcupine Creek and on the minor anticlines of the coastal upfold between Munday Creek and the Priest River are suggested as the most favorable places to test for possible anticlinal accumulation of oil.

Sandstone beds in the exposed part of the Tertiary strata, especially in the Poul Creek and Yakataga formations, show lateral variations in grain size, sorting and thickness that may offer possibilities for trapping oil.

Significant accumulations of oil may be present in the sealed-off reservoir beds along the major faults of the southern structural belt, especially along the Sullivan fault. Possibilities are for accumulations against the Sullivan fault, in the gently dipping beds in the lower part of the Poul Creek formation on the hanging-wall side, and in more steeply dipping reservoir beds in both the Poul Creek and Yakataga formations on the footwall side. Presence of oil seepages along the Sullivan fault indicates that it intersects one or more reservoir beds, but the seepages may also indicate that the fault seal is too imperfect to permit accumulation of large amounts of oil.

Zones of shattered rock affording openings for the accumulation of oil may be present along the major faults and along the tightly compressed upfolds in the Yakataga district. Wells in the Katalla field are believed to have produced from fractured but otherwise relatively impermeable siltstone and sandstone of Middle or Late Oligocene age, in a completely folded and faulted zone.

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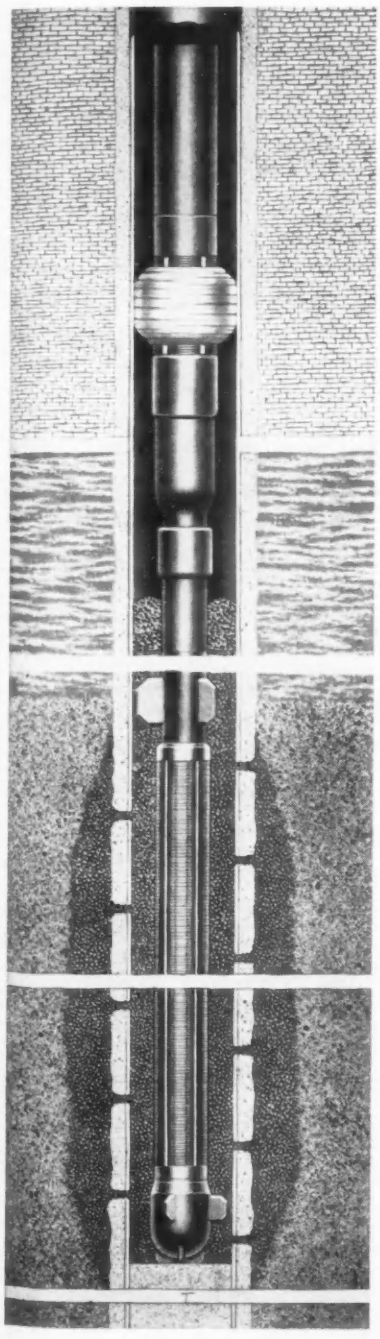

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Of World Oil Men

ALBERT WRIGHT, JR., has been elected to the board of directors of the International Petroleum Company, Limited.

Wright has been coordinator of Indonesian affairs of Standard-Vacuum Oil Company since July 1, 1951, prior to which he was assistant general manager of Standard Vacuum's producing and refining subsidiary in Indonesia.

Born in Havana, Cuba, December 27, 1900. Wright was graduated from Harvard in 1922, having majored in geology. He attended the summer session of the Harvard School for Business Administration in 1937.

His first year after graduation was spent in the interior of British Guiana. This was followed by field geology and drilling crew service on rotary and cable tools in Cuba until he joined the Mene Grande Oil Company in May, 1926. After serving with Mene Grande for 11 years, Wright left Venezuela in November, 1937, to head the operations of Amiranian Oil Company, which kept him in the Middle East until the end of 1938. From December, 1938, Wright served with Standard-Vacuum Petroleum Mij. in Indonesia until the Japanese occupied Java and Sumatra in February, 1942.

Joining the Corps of Engineers in March, 1942, he served in the S.W.P.A. forces from Australia through New Guinea, to the Philippines. Returning to the U. S. in November, 1945, he was assigned temporarily to Holland to reopen and organize Standard-Vacuum's office in The Hague. From there he proceeded to Indonesia in May, 1947, to assume his duties of assistant general manager.

•

E. D. BROCKETT, JR., formerly chief, Exploitation and Engineering Branch, Production Department, Gulf Oil Corporation, has been appointed assistant to the general manager, Mene Grande Oil Company, a subsidiary company of Gulf engaged in oil production in South America. He will be headquartered in Caracas, Venezuela.

•

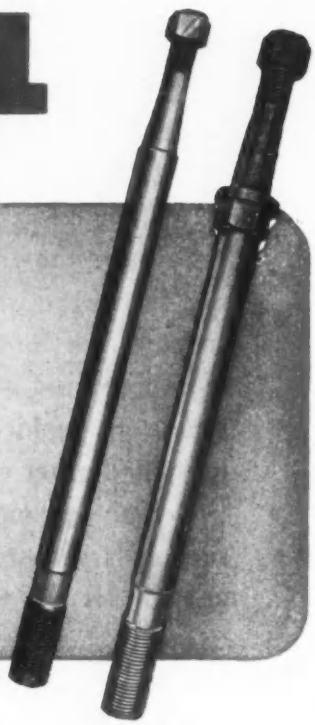
SIDNEY M. BLAIR of Toronto and DONALD L. ROBERTS of Vancouver have been elected directors of Canadian Bechtel Limited. Canadian Bechtel Limited is a subsidiary of Bechtel Corporation.

D. L. Roberts

Both Blair and Roberts are vice presidents of Canadian Bechtel Limited. In addition, Blair is a vice president of Trans Mountain Oil Pipe Line Company.

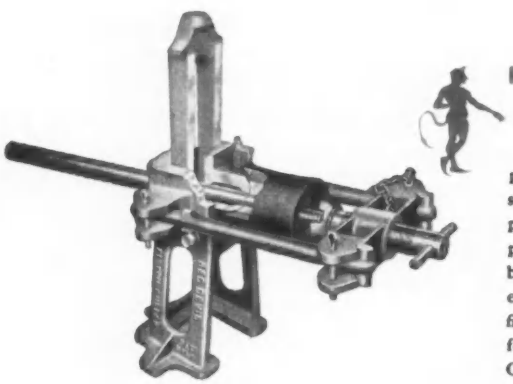
Blair, who was born in Ontario, attended the University of Toronto

RED DEVIL
"DIA-HARD" PISTON RODS



For high pressure abrasive service

RED DEVIL Piston Rods are first choice where drilling conditions are severest because of the extreme hardness of the deep HIGH-CARBON wear resistant "DIA-HARD" case, coupled with tough core properties which give the highest tensile strength against breakage. All rods are hardness tested and precision gauged to maintain a world-wide reputation for quality. Write for Catalog No. P-101.



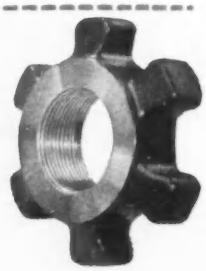
RED DEVIL PISTON PULLER
For tapered type rods

The usual practice of removing pistons from rods by blows of a sledge hammer often damages either pistons or rods. A Red Devil piston puller easily and quickly removes badly stuck pistons without injury to either part. All elements are made of finest quality alloy steel, heat-treated for strength and long life. Write for Catalog No. P-106.

RED DEVIL PISTON ROD LOCK NUT

These "Hammer Lug Type" nuts provide a fast and positive means for locking piston rod in crosshead. Made from alloy steel and heat treated, they will last indefinitely. Face of nut is precision machined for full seating surface at right angles to axis of threads to prevent fatigue stresses in rod. Write for Catalog P-102.

Complete information in Composite Catalog or write for price catalogs noted above. Red Devil products are available through your supply store.



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measures corrosion
measures rod wear

Only the Tuboscope Caliper with base line measures corrosion, erosion, and rod wear easily and accurately. The exclusive Tuboscope base line represents the nominal ID of the tubing. Wall reduction is interpreted readily from the chart by direct comparison of the activated line with the base line. By comparing the ID as shown by the base lines on charts for several surveys of one string of tubing, it is possible to determine whether the ID is increasing — an indication of erosion which no caliper feelers can measure. The easily understood interpretation tells you the exact condition of your tubing. Tuboscope surveys wells under pressure and up to 9,600 feet in one run at speeds up to 100 feet per minute. You can be certain that you know the tubing's condition after a Tuboscope survey. You don't need to pull good tubing. Call Tuboscope now to survey your producing wells.

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Guests of Houston Nomads

Guests at a recent meeting of the Houston Chapter of Nomads were, left to right: John W. Gunn and D. G. Sawyer, Texas Petroleum Company, Bogota, Colombia; Earl Overstreet and Glenn Byers, Shell Oil Company, Houston; E. E. McGar, Shell Caribbean Petroleum Company, Maracaibo, Venezuela, and Staley Kessinger, Creole Petroleum Corporation, also of Maracaibo.

and the University of Alberta where he obtained his M.S. degree in 1924. Prior to joining the Bechtel organization in 1949, he had been engaged in the direction of manufacturing, engineering and research activities in England, the Caribbean area and in Canada.

Roberts, who was graduated from the South Dakota School of Mines with a C.E. degree in 1933, joined the Bechtel organization in Edmonton in 1942. Since then, he has been associated with various Bechtel activities throughout the world. Late in 1950 he was placed in charge of preliminary reconnaissance, cost estimating, engineering, design, field surveys and construction planning of the Trans Mountain project. Since August, 1951, he has been Canadian Bechtel Limited's project manager for the designing, engineering and supervision of the 718-mile Trans Mountain oil pipe line.

•

M. S. MAINLAND has been named general manager of Iraq Petroleum Company field and pipe line operations, with headquarters at Kirkuk. He has been with the company since 1929. P. R. A. SNSOR has been appointed general manager of pipe lines and terminals at Homs, Syria. He was formerly deputy general manager in the Middle East. J. D. GRAHAM, former process superintendent, has been named divisional manager of pipe line and terminals in Syria. H. H. H. CHETWYND-CHATWIN has been named pipe line superintendent in Iraq, and E. CLOUGH pipe line superintendent in Syria. Clough had been deputy chief mechanical engineer of pipe line operations.

ROGER HENQUET, for many years general manager for Schlumberger Well Surveying Corporation in the U: S., and more recently eastern hemisphere representative in charge of Superior Oil Company's Paris headquarters, has opened independent petroleum engineering offices in Paris, France, under the firm name, Societé d'Études Petrolières.

Roger Henquet

•

MORTEZA QUILIKHAB BAYATT, former premier of Iran, has been appointed managing director of the nationalized National Iranian Oil Company. Bayatt, several times a cabinet minister, recently had been the government's extraordinary representative in the Khuzistan oil province.

•

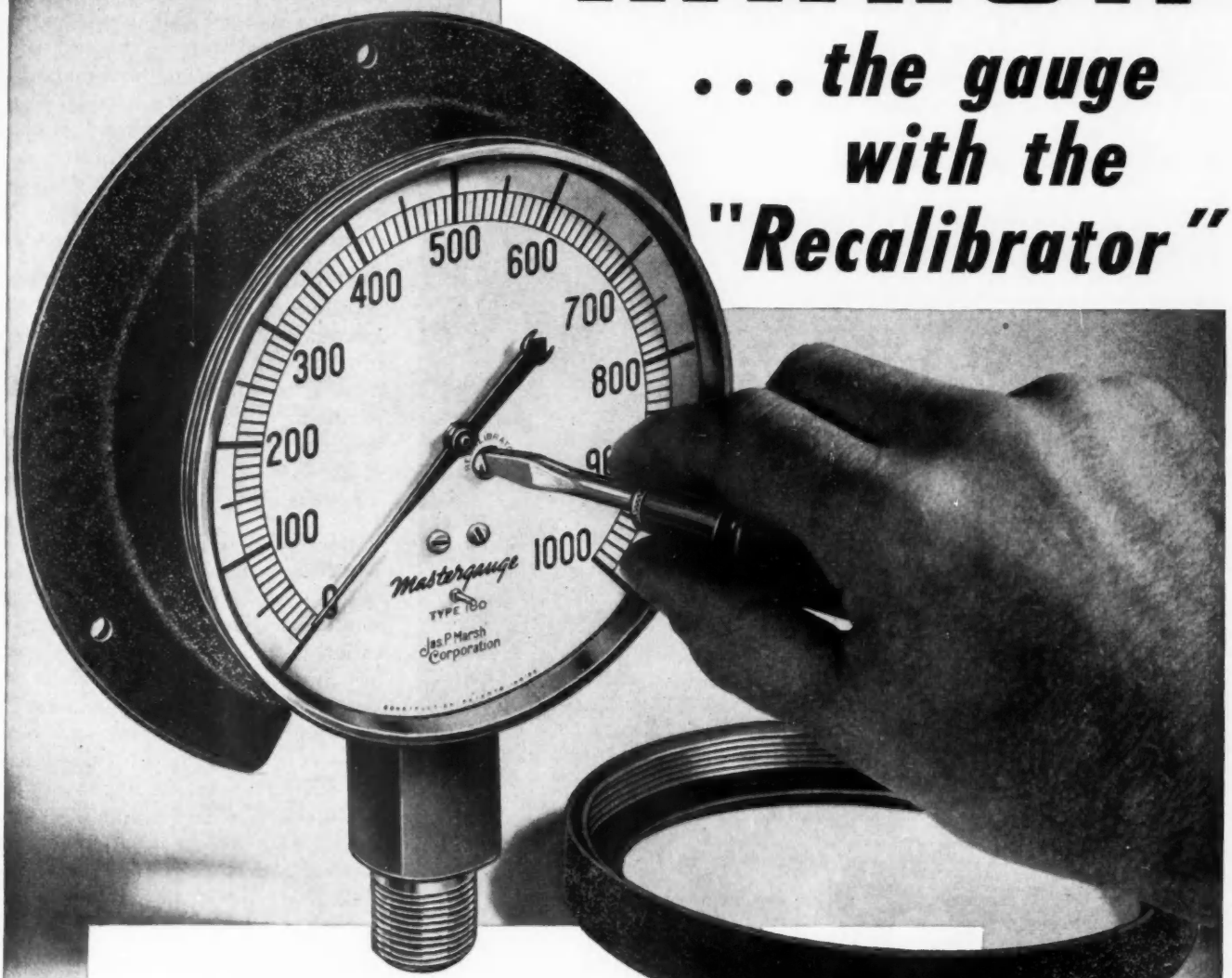
B. A. BROWN, JR., president and managing director of Home Oil Company, Ltd., has been appointed chairman of the company's board of directors to fill the vacancy created by the retirement of MAJ. JAMES B. LOWER, founder and former president, who will remain as consultant.

•

DR. WOLFGANG SCHOTT of the German Geological Survey recently visited Yemen, where he conducted geological studies. Enroute back to Germany, he conferred in Rome with Yemen Prime Minister Seif El Island Hassan.

MARSH

... the gauge with the "Recalibrator"



Any pressure gauge can be knocked out of adjustment, but when it's a Marsh Gauge you can quickly correct it with the twist of the "Recalibrator" screw.

This is not only the handiest way to correct a gauge; it is also the best way. Conventional methods of adjustment simply compensate for the error. The "Recalibrator" corrects the relationship between the movement and the bourdon tube—actually *does re-calibrate* the gauge.

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A WORLD of OIL

By **DON KLIEWER,**
WORLD OIL Staff

AUSTRIA: Because of a shortage of storage facilities, a small, narrow valley in the southern part of the country has been turned into an open air basin capable of storing about 275,000 barrels of fuel oil after construction of a dam by the Soviet Mineral Oil Administration. . . . Motorists crossing the border into any neighboring state may now take along as much gasoline as a standard automobile fuel tank can hold without paying customs tax on the fuel.

AUSTRALIA: That 5700-barrel cargo of Iranian crude which was impounded in the tanker Rose Mary at the Red Seaport of Aden by a months-long wrangle over its ownership has reached Anglo-Iranian Oil Company's refinery at Laverton, near Melbourne . . . It will be recalled that the Aden Supreme Court ruled the oil belonged to Anglo-Iranian, and the cargo was subsequently transferred to an Anglo-Iranian tanker.

RUSSIA: Reports from the Sea Drilling Bureau of the Stalin District claim that twin drilling at the Caspian Sea reached 22,000 feet, and the goal is 46,000 feet . . . Listing indiscreet Soviet leaders, the Communist newspaper Pravda has accused N. G. Alsajew, formerly employed as chief of the Soviet Naphtha Ministry Administration, of having used highly classified material of the Soviet oil industry to write a scientific thesis.

POLAND: When rationing of food, consumer and production goods and raw materials at retail level was abolished recently, prices jumped from 5 percent to 15 percent for petroleum products . . . For example, a gallon of kerosene now costs the equivalent of three hours labor by the average wage earner.

HUNGARY: Discovery of oil in Northern Yugoslavia, at the border of Sovietized Hungary, has speeded joint Soviet-Hungarian search exploration programs in the Nagy-Kaniza area in the southern part of the country . . . By beginning immediate installation of new pumps and compressors in the fields, it is evident that the Soviets are trying to get into active production earlier than the Yugoslavs. The area is located between Lovaszi and Nagy-Kaniza . . . In the Zala fields, Soviet fast drilling methods have resulted in up to 6000 feet of drilling in excess of the prescribed objective, it is claimed . . . This area is operating under the pair-competition system which engages two drilling crews in permanent contest.

SWITZERLAND: The country's second deepest wildcat was drilled in 180 days to a depth of 5971 feet without finding oil. Situated near Altishofen, in the Hauptrogenstein area, the wildcat hit Molasse sandstone at 4265 feet and 1640 feet of lime rock formation.

KUWAIT: American Independent Oil Company and Pacific Western Oil Companies are readying their sixth well in the Neutral Zone between Kuwait and Saudi Arabia for a test down to 9000 feet . . . The

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THE ROYAL BANK OF CANADA

Over 770 branches in Canada and abroad

companies brought in their fifth dry hole in the Neutral Zone last year.

INDIA: Oil-bearing formation has been found at 9700 feet by Assam Oil Company's Nahorkitya test well in the Digboi area, however, the well will be drilled to 15,000 feet.

PAKISTAN: Sardar Abdur Rab Nishtar, minister of industries, said preliminary steps are being taken to seek oil at Zia, 60 miles from Sui, Baluchistan, in a "promising" locality . . . A second well is being drilled at Patia, in Chittagong . . . Another well is being drilled at Patharia, in Sylhet . . . A new oil field has been discovered in North Punjab . . . In Sui, where natural gas has been found, another well is being drilled to determine the quantity of gas . . . Zin is developing into a promising area, and intense exploration program is scheduled . . . Surveys completed in Khairpur State have yielded valuable information, and deposits of crude are indicated . . . the Government has amended its petroleum law so that it may, at its discretion, grant such further renewals of exploration licenses as it considers necessary provided the total license period does not exceed four years.

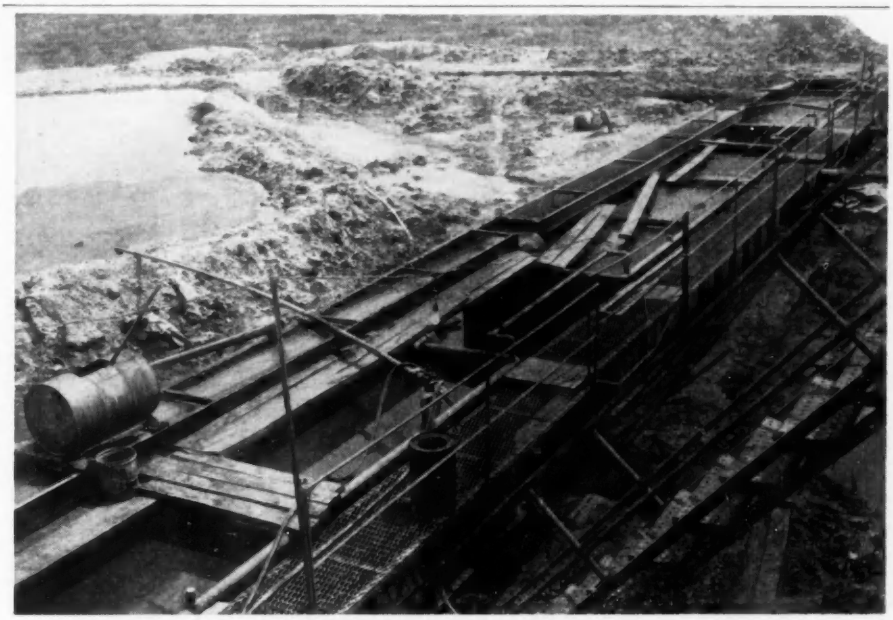
AFRICA: Opening of a new ocean installation at Dakar extends Anglo-Iranian Oil Company's international oil bunkering facilities to more than 140 ports in Europe, Africa and the Far East . . . This expansion has resulted in the AIOC reinstating ports of Massawa, Eritrea; Rangoon, Burma; and Sfax, Tunisia. New additions include ports at Bremen, Bremerhaven, Emden, Nordenham, Vegesack, Brake, and Farge, Germany; Agadir, Morocco; and Port Louis, Mauritius.

ROUMANIA: Thirty-one oil wells were reactivated during December in the Ploesti fields, 18 in the SovRum Petrol No. 1 enterprise and 13 in the No. 2 sector . . . Government plans call for further extension of natural gas use in a drive to relieve the nation's economy from imports of solid fuel . . . Intensified political work will be carried out to counteract growing absenteeism in the Ploesti oil fields . . . Apparently, Ion Dumitru, the oil industry minister, has at least one more purge fear free year in the offing: the statistical office of the republic reported the Roumanian oil industry was 1.6 percent above its 1952 planned quota . . . The relief for Dumitru is occasioned by the growing trend toward purging ministers for non-fulfillment of quotas.

GERMANY: Exploration well Rot 3 (joint interest concession of Itag and Wintershall AG.), situated about 9.3 miles south of Heidelberg, has struck oil at 2133-2297 feet in a fissure deposit in the Triassic (Lettenkohle). The Rot structure is on the edge of the Rhine valley Graben and was located by reflexion seismic parties . . . Wildcat Molbergen 2, currently being drilled by Deutsche Vacuum Oel AG. on a joint interest concession of Gewerkschaft Brigitta and Deutsche Vacuum, has encountered oilbearing layers in the White Jurassic at 2362-2428 feet. Situated five miles north of Hemmelte-West oil field in South Oldenburg, the well's recent drill stem test resulted in a good flow of crude.

SWEDEN: At Varnamo, a slot machine for gasoline has been put into service . . . A similar machine is scheduled to be set up at Stockholm.

CANADA: Imperial Oil Limited has posted a price of $2.36½ a bar-



Mud System furnished by S&R Pierce Junction Field, Houston, Texas

S & R MUD PIT

Hundreds of S&R Mud Pits are in use by operators throughout the Oil Industry. S&R Mud Pits are practically indestructible . . . with any reasonable care in loading and transporting, they will give years of service.

Standard pits are 6′ deep, 30′ long, 7′6″ wide and have a capacity of 234 barrels. Bottoms are 1/4″ steel plate; sides of 3/16″ or 1/4″ as specified. Heavy reinforcing . . . 3″ channel iron ribs on 36″ centers . . . provides utmost strength and rigidity along the sides. Top cross braces are above the mud level in the tank, so that the interior is absolutely free of obstruction. A clean-out plate is furnished at one end.

S&R Steel Mud Pits are skidded on 6″ H-Beams, with heavy cross-braces along the length. Skids are 8′ wide and 33′ long; the pits may be hauled on any standard oil field trailer. Beams are recessed at each end, so that the winch line may be snubbed or wrapped around the ends of the braces for speed, safety and convenience in loading and unloading.

Write for further information and catalog.

S & R TOOL AND SUPPLY CO.

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rel for D2 and D3 zone oil and $2.24½ a barrel for Lower Cretaceous crude in the Acheson Stony Plain field . . . Three British companies—Lobitos Oilfields, Anglo-Ecuadorian Oilfields and Premier Consolidated Oilfields—are expected to enter the Canadian oil play . . . The Board of Transport Commissioners has authorized Trans-Mountain Oil Pipe Line Company to build a 5½-mile branch pipe line from Sumas, B. C., to the U. S. border to carry surplus oil to the U. S. after British Columbia requirements have been met from the throughput of the company's main line running from the Alberta oil fields to Vancouver, B. C. . . . Canadian Southern Oils Limited has budgeted funds to drill or participate in the drilling of 230 wells on its holdings in Saskatchewan, Alberta and British Columbia this year. The program will include a minimum of 40 exploratory tests and about 190 development wells . . . Premier Manning said in Alberta recently that the province's need for export outlets for surplus natural gas is becoming "extremely serious" . . . Texaco Exploration Company has discovered oil at Enchant, 25 miles north of the Taber oil field in Southern Alberta. The well topped the Mississippian formation at 23,351 feet, and oil appeared 44 feet below the top.

Union Oil Company of California has sold its interest in Trans Mountain Oil Pipe Line Company. This action came after a decision of the company not to build a refinery in the northwest area, at least at the present time. This decision plus "other developments" caused the company to feel it no longer was desirable to tie up company funds in the pipe line venture. The 100,000 shares owned by Union, originally purchased at $10 per share, Canadian currency, were sold for $41.50 a share, Canadian currency.

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New Gas Well Brought In By Sicilian Test

On February 16 at San Guiseppe la Rena in the district of Catania town, the first well was drilled under the oil and gas research permit issued by the Sicilian Regional Government to the Eavalso Company. The well has been drilled to 2215 feet, and natural gas was discovered at 1463-1473 feet and 1644-1657 feet with a daily yield of 706 thousand cubic feet.

British oil interests drilling a test north of the Etna mountain expect to reach oil structures at a depth of 5249 feet after geological tests which were made during the last week in February.

Azienda Generale Italiana Petroli is scheduled to conduct an extensive search for natural gas in central and western Sicily under an agreement which is currently being negotiated between AGIP and the Sicilian Regional Government. The pact will put the Italian oil and gas monopoly on a privileged status in Sicily.

Italian Gas Industry Accelerates Expansion

During 1952, Italy's natural gas production increased 50 percent from the previous year, reaching 176 million cubic feet daily during December.

The industry began 1953 with its principal gas resources controlled by Azienda Generale Italiana Petroli in the Cortemaggiore, Ripalta, Caviaga, Cornegliano, Bordolano, Ravenna and Correggio fields. The current yield of these fields is estimated to be on the order of 424 Mmcf. daily.

In operation at the beginning of the year were 963 miles of main gas

lines and 538 miles of secondary pipe lines. Major cities served by the lines include Milan, Cremona, Brescia, Bergamo, Pavis, Como, Varese, Turin, Novara, Bologna and Ferrara. This year, gas lines will be extended to Genoa, Aosta, Vicenza, Trento, Sondrio, Vercelli, Treviso, Alessandria and Mantova.

Also, it has been confirmed that AGIP has discovered an important gas structure at Rapagnano in the province of Ascoli Piceno, where natural gas production has already reached 31 Mmcf. daily. It is estimated that the Rapagnano structure may increase its yield to approximately 35 Mmcf. daily and that this rate may be continued for at least ten years.

Europe Oil Council At Moscow Proposed

Inauguration of an all-East European Oil Council, with headquarters at Moscow, is planned for the immediate future. Development of this new setup stems from the operation during the past several years of the Foreign Department of the Soviet Naphtha Ministry of Moscow.

Major change in the new organization is the participation of national delegations of the Soviet Union, Poland, Czechoslovakia, Roumania, Albania and Bulgaria. Soviet Mineral Oil Administration of Austria—all Soviet citizens—have seats and full voting power in this institution.

It is also planned that a number of administrative combines will be formed.

- The Northern Combine, with all Ukrainian and Polish oil fields, will have headquarters in Lemberg, Poland, and will manage Galician and Ukrainian oil fields.

(It may be remembered that the Soviet Union returned a border district with large but almost exhausted oil fields to Poland three years ago. This "return," for which Poland had to exchange an equal-sized stretch of arable land farther north, has proved useless to the Polish economy.)

- The Central (or Middle) Combine will be composed of Czechoslovakian and the now Soviet-operated Austrian oil fields.
- The Southern Combine consists of Hungary, Roumania and Albania.

In the Far East, a Soviet-Chinese Combine was established in 1952.

Chairman of the Combined Oil

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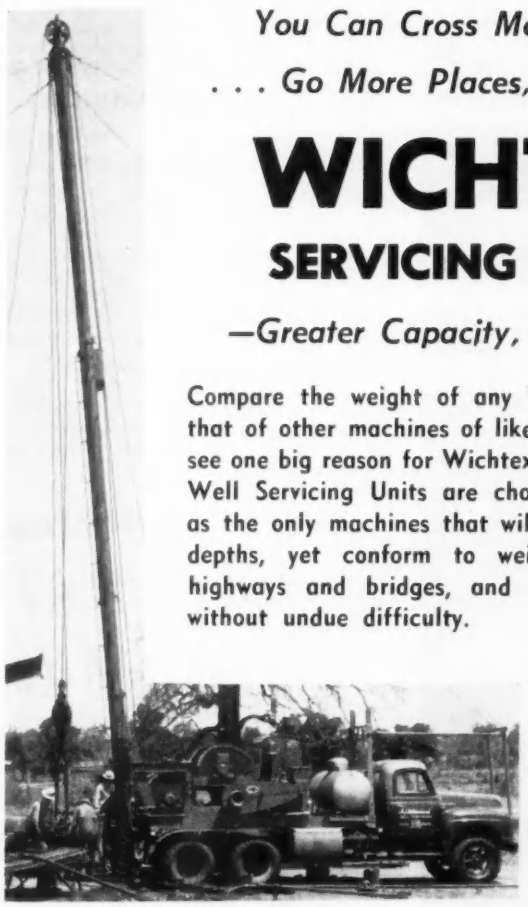
SERVICING UNITS

—Greater Capacity, Less Weight

Compare the weight of any Wichtex model with that of other machines of like capacity and you'll see one big reason for Wichtex popularity. Wichtex Well Servicing Units are chosen, in many cases, as the only machines that will service to required depths, yet conform to weight maximums for highways and bridges, and cross rough terrain without undue difficulty.



Write today for the booklet that lists weights, capacities, and other specifications for Wichtex Rod, Tubing and Bailing Machines, ranging to 15,000-foot capacity, and Wichtex Drilling In and Cleanout Machines, ranging to 8,000-foot capacity.

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OIL FIELD SPECIALTY ITEMS

Council will be a Soviet citizen, probably the present chief of the Foreign Department of the Soviet Naphtha Ministry. Leaders of the national delegations will be appointed deputy chairmen of the council.

Major points on the agenda for the unification of East Europe and the Communist Asiatic oil business are the establishing of overall production orders, then the integration of the individual oil fields into larger production areas. Establishment of independently operating oil production centers will be the ultimate goal.

Pipe lines are scheduled to be built to connect the various regions of the combine. Lines reportedly will connect Poland and the Ukraine, Hungary and Roumania, Czechoslovakia and Austria, and Roumania and the Ukraine, which will serve as the central terminal for the participating lines.

3 New Aldorf Field Wells May Become Producers

Wintershall AG's extension wells Aldorf 2 and 3 and the development well Aldorf 4, situated in Germany newly-explored Aldorf oil field (between Bremen and Osnabrueck) have recently been completed. Core drill tests have given rise to the hope that all three wells will become productive.

Of particular interest is the fact that in the new holes, apart from the Dogger epsilon, new oil sands have been encountered in the Malm which were absent in the well Aldorf 1.

The new wells are situated south and southwest of Aldorf 1. Aldorf is about 4920 feet and Aldorf 2 about 3280 feet from Aldorf 1. Aldorf 4, which is between Aldorf 1 and the two extension wells, encountered the oilbearing Dogger about 165 feet higher than Aldorf 1, whereas in Aldorf 2 and 3 the oilbearing horizon is about 33-65 feet higher.

New Canada Budget Has Exploration Allowance

Canadian Finance Minister Douglas Abbott included concessions to the oil industry when he brought down his budget in the federal House of Commons for the fiscal year 1953-54.

In the past, an oil company received no consideration for income tax purposes for money it might spend on exploration. The metal mining companies got no credit for oil exploration.

The new budget provides that the two groups will be combined for purposes of allowances for exploration expenses.

"It is hoped," Abbott said, "that the result of this change will be greater participation by Canadian capital in the oil and gas industry."

The budget also provided that allowances now granted for production expenses, including a special provision for deep-test wells, will be continued for another year.

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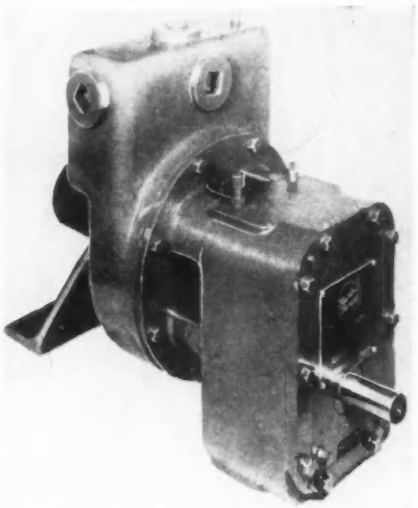
TANDEM OR SINGLE AXLE SEMI-FLOATS
ALL TYPES OF POLE TRAILERS

Heavy loads over rough oil fields demand trailers and floats that are built rugged and can assure safe arrival of valuable equipment. That's why, for over thirty-six years, leaders in the oil industry have chosen "Loadcraft" to do the job. Bodies, fifth-wheel, axles and brakes are all designed and built right in the Loadcraft factory by experienced, quality-conscious Loadcraftsmen. Loadcraft Trailers have proved to be the work-horse of every oil field.

SPENCER SAFFORD LOADCRAFT INC. AUGUSTA, KANS.

New Equipment

Supplementing Composite Catalog



Truck Pump Line

Marlow Pumps has announced a new line of type G pumps for direct connection to the power take-off of tank trucks. The geared speed increaser has been completely redesigned, and design changes in the pump itself resulted in smaller size and less weight. All four basic models of the pump are self priming centrifugals with Marlow patented diffuser type priming. Each can be supplied for clockwise or counter-clockwise shaft rotation and choice of five discharge ports.

This item supplements Marlow Pumps data on page 3196 of Composite Catalog, 19th Edition.

Circle No. 1 on Postcard

Flame Cutter

A new flame-cutting machine known as the Vernon "Universal" Flame cutter has been announced by Vernon Tool Co., Ltd. The cutter is a precision tool used for reworking, reconditioning and salvaging all types of new and used welding ells, tees, flanges and reducers. Mounted on a steel base, the flame cutter has a unitized control panel and unitized gas control valve. The table which holds the fitting revolves in either direction at speeds varying from 0 to 5 rpm. The adjustable degree plate permits the fitting to be cut at any desired angle.

This item supplements Vernon Tool Co., Ltd. data on pages 5055-5060 of Composite Catalog, 19th Edition.

Circle No. 2 on Postcard

Hydrojib Drilling Rig

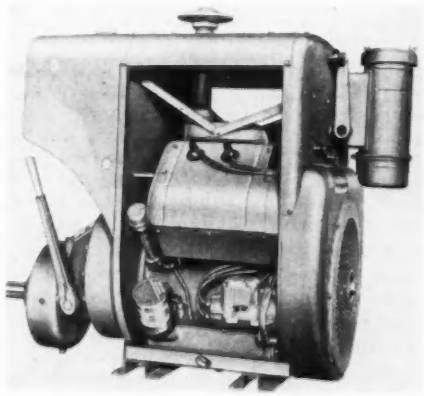
The Joy "Hydrojib" pipeline drilling rig, a self-contained unit for drilling blastholes on either right-of-way or ditch work, has been announced by Joy Manufacturing Company. Designed to be assembled by the contractor or by a construction equipment distributor, the "Hydrojib" rig carries two Joy 3½-inch rock drills on 6-foot chain-type feeds mounted on 10-foot hydraulically actuated Joy dydro drill jibs. Compressed air supply is maintained through a Joy WI-80 air compressor mounted on the rear of the tractor and driven through power take-off. Air receivers are built into the rig and all the necessary equipment can be mounted on a used tractor.

This item supplements Joy Manufacturing Company data on pages 2737-2756 of Composite Catalog, 19th Edition.

Circle No. 3 on Postcard

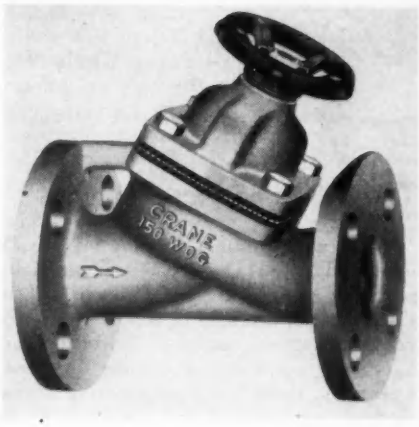
Wisconsin Engine

Most recent addition to the Wisconsin heavy-duty air-cooled engine line is the new four-cylinder, V-type model VG4D. This engine has a 3½-inch bore, 4-inch stroke and 154 cubic inch displacement developing a peak rating of 36 horsepower at 2200 revolutions per minute. This model is lightweight and compact in design, simplifying the problem of engine installation on modern equipment where weight and space limitations are important. The new model has the traditional features of Wisconsin engines—the tapered roller main bearings, dynamically balanced forged crankshaft, mirror finish on crank pins, Stellite-faced exhaust valves, valve seat inserts and honed cylinders for long, dependable heavy duty engine life. Positive cooling is obtained even at very high temperatures from a large fan cast in the flywheel which forces a strong blast of air across and around the cylinders and heads. When specified, these engines may be equipped to operate on kerosene, fuel oil or natural gas.



This item supplements Wisconsin Motor Corporation data on page 5261 of Composite Catalog, 19th Edition.

Circle No. 4 on Postcard



Diaphragm Valves

Crane Co. has announced the addition of several new body, diaphragm and lining materials to its line of packless diaphragm valves. The valves are now regularly available with cast iron, brass, aluminum or 18-8 Mo bodies and disc holders and with diaphragms and disc inserts of Neoprene, Buna-N and soft natural hard rubber linings. Specially prepared valves for vacuum, oxygen and acetylene service are also regularly available. A feature of the Crane diaphragm valves is the separate diaphragm and disc construction. Since the diaphragm is not used for seating, it is not subjected to the cutting, crushing and abrasion that lead to rapid wear. Closure of the independent disc will prevent escape of line fluids even if the diaphragm should fail.

This item supplements Crane Co. data on pages 1346-1347 of Composite Catalog, 19th Edition.

Circle No. 5 on Postcard

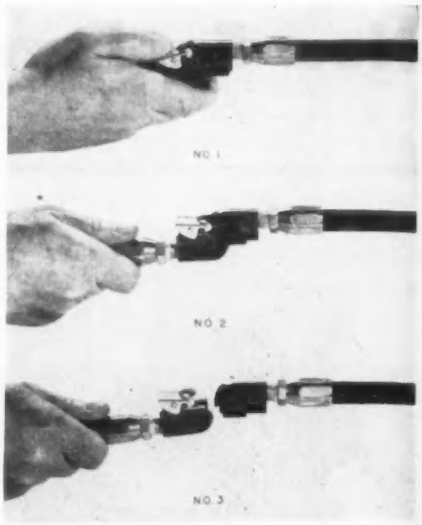
Save time! Keep informed! Circle numbers on postcard, page 307, corresponding to items on this page.

Gauging Hatch

The Enardo Manufacturing Company, Tulsa, has started shipments on a new gauging hatch designed for tanks where toxic gases constitute a personnel hazard. Already in use in the West Texas sour crude fields, the Enardo series 300 safety gauging hatch gives protection against hydrogen sulphide and other harmful fumes and speeds up the entire gauging operation. Mounted conveniently near the walkway, the device consists of a gauge opening, vent pipe, and simple swing check valve operated by a foot lever through an adjustable bar and linkage. The gauger merely opens the gauging lid, passes the plumb-bob and tape in far enough to close the lid, then presses the foot pedal to open the valve and allow the plumb bob and tape to pass down into the tank. While the valve is open the toxic gases escape safely through the vent pipe above the gauger's head. In withdrawing the tape the procedure is just the opposite, thus protecting the operator at all times.

This item supplements Enardo Manufacturing Company data on pages 1610-1611 of Composite Catalog, 19th Edition.

Circle No. 6 on Postcard



Slide Seal Coupling

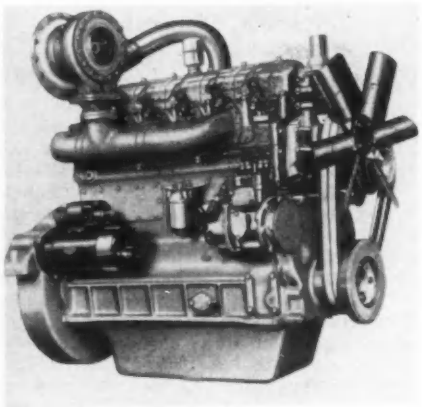
Aeroquip Corporation of Jackson, Mich., has developed a new slide seal coupling which permits instant connection and disconnection of fluid-carrying lines by a simple push-pull action. Consisting of two simple two-piece die-cast aluminum assemblies with rubber "O" rings, the slide seal coupling is lightweight, compact, and low in cost. Fluid-carrying lines equipped with the coupling can be disconnected instantly by (1) pressing the lock lever which causes the coupling halves to separate a fraction of an inch and automatically holds the lock open, (2) gripping the coupling halves or hose line, and (3) pulling lightly. This completes the separation with each half forming a perfect seal. Aeroquip couplings may be used with a wide range of fluids such as hydraulics, water, hot oil, crude and fuel oils, anti-freeze solutions, gasoline, diesel fuels, air and others.

This item supplements Aeroquip Corporation data on pages 164-165 of Composite Catalog, 19th Edition.

Circle No. 9 on Postcard

Turbocharged Diesel Engines

Waukesha Motor Company has made use of the availability of commercially produced turbochargers of small size to extend the advantages of turbocharging to relatively small engines. Turbochargers have been applied to five basic diesel engine sizes, three for transportation or industrial service and the two largest as complete power units for industrial service. The 1197 cubic inch model is supplied either as a bare engine or complete unit. Extension of turbocharging into this lightweight high-speed engine field is in the nature of a milestone and could well have lasting and far-reaching effects. All Waukesha turbo-supercharged diesels use American Bosch injection equipment suited to the engine size. The primary reason for turbocharging is to obtain higher specific output from an engine. This means a better horsepower/weight ratio, improved mechanical efficiency and better fuel efficiency.



This supplements Waukesha Motor Company data on pages 5102-5103 of Composite Catalog, 19th Edition.

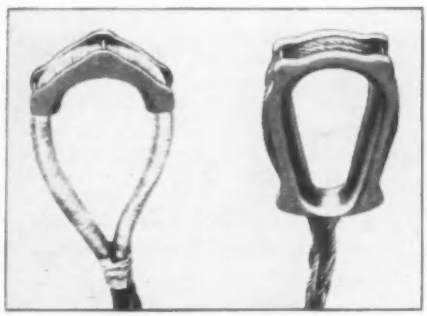
Circle No. 7 on Postcard

Corrosion Inhibitor

Gypstone Water-Treet is a scientific blended process of phosphate chemicals used in the treatment to overcome corrosion and precipitations from waters without harmful effects to the water or equipment. Water-Treet has been used for the past four years for treating gypsum conditions such as hydrogen sulphide, calcium sulphate, magnesium carbon conditions and various other gypsum conditions prevailing. Water-Treet comes in ¼-inch lump (to be used when the operator has a 5½ inch casing or 7-inch OD casing) or in a ½-inch lump (to be used in a 7-inch OD casing). Manufactured by Mid-State Chemical Company, Inc., Water-Treet is an additive in drilling mud which will retard corrosive conditions after casing is set.

This item supplements Mid-State Chemical Company, Inc., data on page 3403 of Composite Catalog, 19th Edition.

Circle No. 10 on Postcard



Braided Wire Rope Sling

A new eight-part braided sling has been introduced by A. Leschen & Sons Rope Company and features a new type reuseable thimble fitting reported to save sling users up to 20 percent or more. These pin-lock thimbles are attached by pins instead of conventional hammered-down clamps and are readily removable for reuse. Since sling fittings generally outlast the sling itself, substantial savings are gained by their reuse. For example, on a sling made of ½-inch wire rope of ten feet in length, the manufacturer claims that reuse of two full thimbles produces a savings of 23.6 percent.

This item supplements A. Leschen & Sons Rope Co. data on page 3026 of Composite Catalog, 19th Edition.

Circle No. 8 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 307

Other New Equipment

Oil Rig Bogies

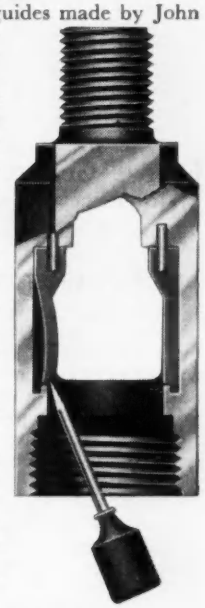
To save time and money, particularly for exploratory purposes, Cranes (Dereham) Limited, South Green Works, Dereham, Norfolk, England, has produced oil rig bogies to transport the 90 to 100 ton drill rig equipment.

The new product used in sinking oil wells, consists of three bogies, one fitted to the cantilever projecting in the center of the structure at the front and one on either side supporting the structure on similar cantilevers. Each bogey is mounted on 21.00 x 25 x 30 ply tyres and is of the simplest construction. In the center of each a hydraulic ram is fitted, the ball end of which engages into a spherical cast on one of the cantilevers. When necessary to move a rig, the bogies are coupled to the structure each to its own cantilever, and by hydraulic means the oil rig is lifted from the ground. The front bogey is attached by a drawbar to a tractor or tractors while the bogies at each side have their drawbars connected to fixed points on the oil rig structure so that they are self-steering when the structure is moved forward.

Circle No. 11 on Postcard

Rubber Guide Cages

Hycar rubber ball guides made by John N. Martin, Manufacturer, are now easily replaceable. These resilient guides cannot "beat out" and can stand sand abrasion better than any metal. Considerable improvement is expected in the ball and seat life. Guides are made in all sizes from 1 inch to 4¾ inches in open and closed types. Closed type cages have stainless steel retainer band holding the upper portion of the rubber guides in place. The top of the closed type guide is shaped to fit under the retainer and the lower portion fits into the back groove.



Circle No. 14 on Postcard

Truck Crane

A new six-ton truck crane has been added to the line of products of Thew Shovel Company. The Lorain Model TL-10 crane consists of a complete superstructure equipped as a lifting crane which also can be used as a ⅜ yard dragline or clamshell. The crane is designed primarily for field mounting on a suitable new or used truck furnished by the customer. Other applications are as mounting on piers, barges, bins ship docks, trailers and flat cars.

Circle No. 15 on Postcard

Emergency Light Unit

In case of power failure, the unit manufactured by General Scientific Equipment Company provides maximum protection and sufficient illumination to carry on operations for many hours. Designed primarily for industrial plants, laboratories and institutions, the unit provides light instantly without touching a switch in the event of failure of regular power. The unit is powered by a storage battery built into the portable set and a trickle charger automatically maintains the charge of the battery. There is nothing to install; simply plug into any A.C. circuit.

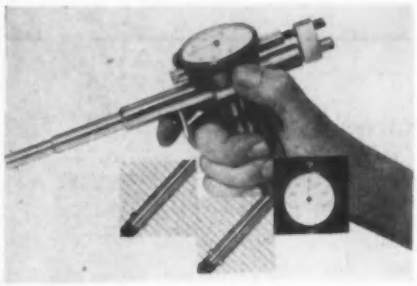
Circle No. 12 on Postcard

Oil Storage Tank

A new type of corrosion-resistant crude oil storage tank is offered now by Murdock Tank & Manufacturing Company. The new bolted lease tanks are made of reinforced plastics, combining Fibreglas mat and Laminac polyester resin. They range from 250- to 3000-barrel capacities. Fibreglas-Laminac material is reported impervious to damage by hydrogen sulfide gases, salt water, electrolytic action and other deteriorating influences from crude oil storage. The new material also cuts down vapor losses common in metal tanks as it has thermal conductivity of about 1/20th that of steel. The plastic material does not expand and contract under varying temperature extremes, protecting bolted sections.

Circle No. 13 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 307



Groove Gauge

Measurement of small internal groove diameters is made quickly with a new line of "P" gauges manufactured by Rimat Tool Company. This new line supplements the company's regular line of groove gages and inside micrometers. Measurement of thread reliefs, bypass reliefs in hydraulic mechanisms and small bores are among the uses of these gages. Use of the Rimat dial bore gages is not limited to measuring "O" ring and snap ring grooves but can be applied to straight bore measurement and other internal recesses which lie within their measuring range.

Circle No. 16 on Postcard

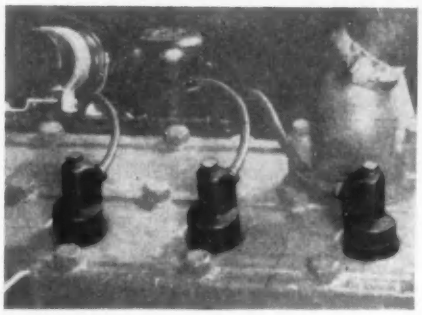
Magnesium Barrel Skid

A new magnesium barrel skid for drum and barrel handling is offered by Magline, Incorporated. Of welded construction throughout, the barrel skid is fabricated entirely of magnesium, making the skid easy to handle yet strong. The handling of drums and barrels is made speedier and the risk of lifting injuries is greatly reduced, thereby assuring better safety to the men and the equipment. Available in standard sizes of from 5 to 18 feet long, the skids also are manufactured in special sizes.

Circle No. 21 on Postcard

Spark Plug Protection

New activated Spar-Kover manufactured by Lucas Products Company protects spark plugs from shorting out. The special ceramic cartridge absorbs moisture and condensation around plugs and the watertight cover protects plugs from dew, fog and splashing water. Installation is easy and Spar-Kovers are available for all spark plugs to be used for any type ignition-fired engines. Suggested applications are for gasoline lawn mowers, motorcycles, trucks, construction equipment, farm tractors and portable arc welders.



Circle No. 17 on Postcard

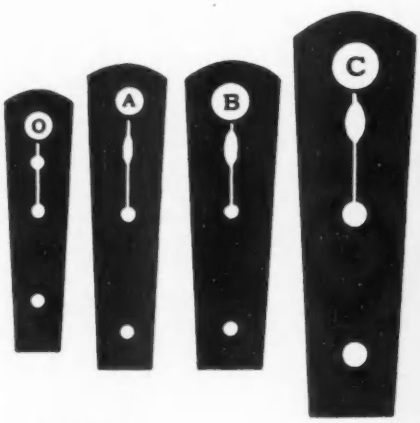
Braided Steam Hose

Ironsides Steam Hose is the trade name of a hose combining wire braided and glass cord construction, developed by Quaker Rubber Corporation, a division of H. K. Porter Company, Inc. Especially developed for finishing work, the hose features double strength construction.

Circle No. 19 on Postcard

Galion Graders

Models 104 and 118 motor graders of the Galion Iron Works & Manufacturing Company are available with General Motors two-cycle diesel engines in addition to the International Harvester diesel engines which formerly powered these graders. Addition of the new line of engines gives the graders slightly more horsepower and enables grader users with GM diesel power in other equipment to standardize their equipment.



V Link Belt

Two new features of the "V" Link Belting of the Brammer Corporation are a new simplified size identification system and a natural rubber compound which greatly increases the flexibility of each link so that links may be added or removed by hand without using tools. All Brammer belts now will have the size symbol of the belting embossed on each rivet head, eliminating the need for measuring belt sizes.

Circle No. 22 on Postcard

Portable Crane

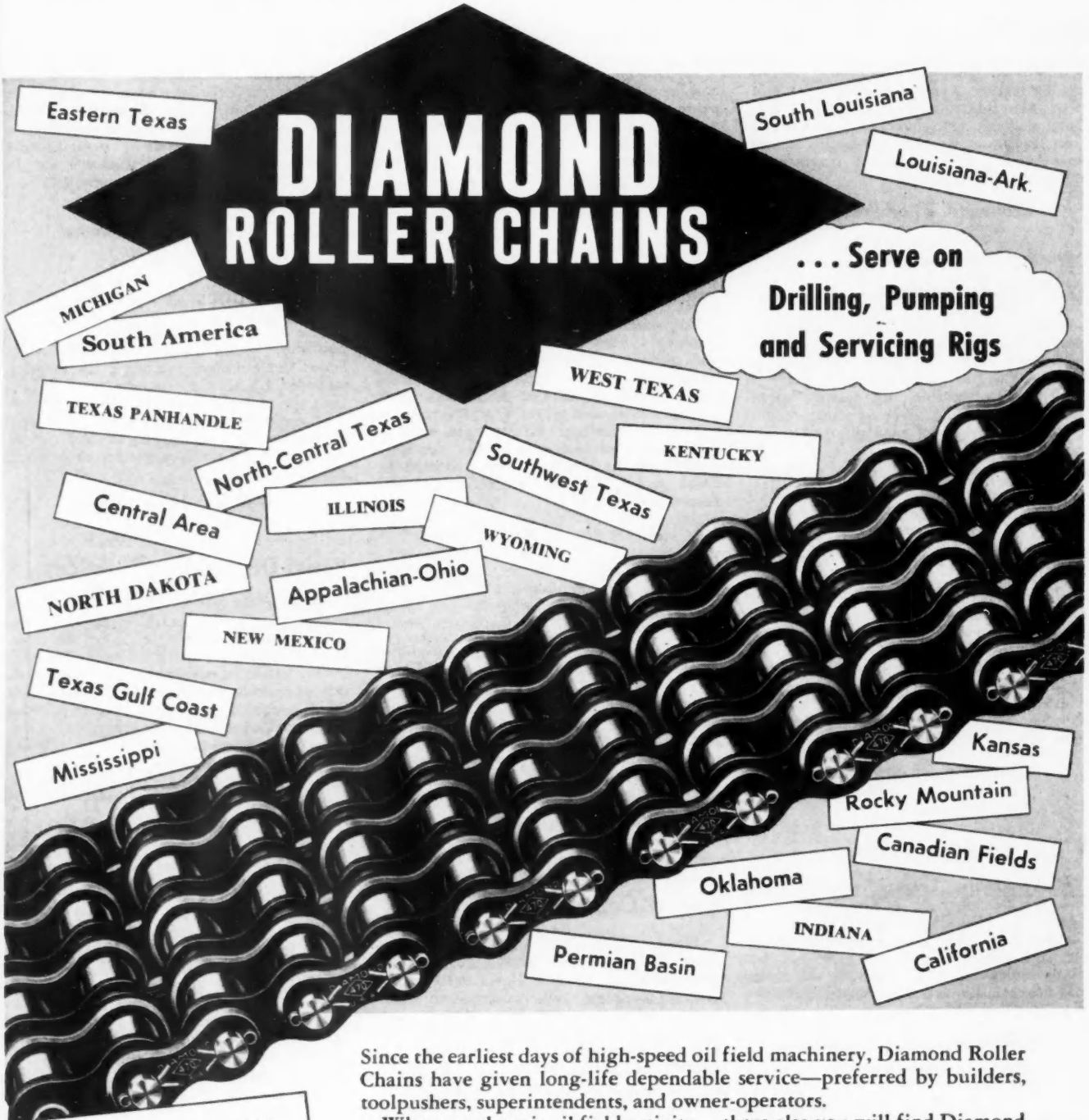
A Barrett electrically operated revolving base portable crane speeds movement of barrels and provides a safer method. The crane does not have to be loaded; instead, it picks up the load, reaching over rows of piled material if necessary. In addition to conventional movements of materials, portable cranes offer advantages for handling heavy parts for machining, die handling, loading and unloading motor trucks and freight cars and for assembling and dismantling machinery. Capacities of these cranes, which are manufactured by Barrett-Cravens Company, are from 500 to 5000 pounds.

Circle No. 18 on Postcard

Circle No. 20 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 307

IN ALL ACTIVE OIL FIELDS



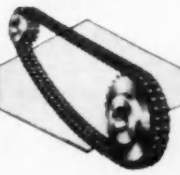
Shot-Peening Since 1944
Diamond Chain has long recognized that certain types of internal stressing of chain parts would increase fatigue resistance. To this end, link plates have been specially processed and chain rollers and other parts have been shot-peened since 1944.

And
Patented BCL Connector
The patented bushed center plate connector for multiple-strand press fit center plate chain has simplified connecting and disconnecting and assures full value in the chain at the connecting link.

Since the earliest days of high-speed oil field machinery, Diamond Roller Chains have given long-life dependable service—preferred by builders, toolpushers, superintendents, and owner-operators.

Wherever there is oil field activity,—there also you will find Diamond Chains on the finest drilling, servicing and pumping equipment that American builders produce.

DIAMOND CHAIN COMPANY, Inc.
Dept. 485, 402 Kentucky Ave., Indianapolis 7, Ind.
***Tulsa Office:* 2238 Terwilleger Blvd.**
Offices and Distributors in All Principal Cities
Refer to the classified section of your local telephone directory under the heading CHAINS or CHAINS-ROLLER

DIAMOND  **ROLLER CHAINS**

New Catalogs and Equipment Literature

Oil Field Equipment

Link-Belt Company published a new catalog listing a wide variety of equipment including chain, sprockets, bearings, shale shakers and shovel-cranes. Illustrations, tables of weights, strengths, dimensions and other pertinent engineering information is included.

Circle No. 23 on Postcard

Welding Equipment

Modern Engineering Company has completed its new catalog which contains description of every type of welding equipment of "Meco" manufacture. A guide to oxy-acetylene welding and cutting operations, the catalog gives specific recommendations for use of each piece of equipment.

Circle No. 24 on Postcard

Specialized Tools

McCullough Tool Company has issued a general catalog listing specialized tools and services available to the oil industry. Included in the descriptive material are the Burrless Bullet, the glass jet perforators, radiation well logging with the new scintillometer, the Magna-Tector, back-off services, jet casing cutters, bottom hole cutters and casing collar shots.

Circle No. 25 on Postcard

V-Belt Bulletin

High capacity "Texrope" belts for tough jobs are described in a new bulletin released by Allis-Chalmers Manufacturing Company. The belts are recommended for use in tight spots, for compactness, for changed peak loads, for resisting oil, water and chemical, and for cutting sheave costs.

Circle No. 26 on Postcard

Power Cranes and Shovels

A book containing discussion of principles of power shovel and crane operation is available from the Koehring Company of Milwaukee. Capabilities of various excavator and crane attachments are outlined with prescribed requirements for most efficient operation of these machines. Proper selection of equipment for ordinary operating situations are discussed and drawings, tables and photographs are included.

Circle No. 27 on Postcard

Corrosion Problems

A booklet to solve corrosion problems has been released by the Tapecoat Company. Details on how and where coal tar protection can be used to best advantage and case histories to show how corrosive problems have been overcome in many fields are reported.

Circle No. 28 on Postcard

Bulldozer Catalog

Caterpillar Tractor Company has released a catalog on Caterpillar Bulldozers and their attachments illustrating sizes, styles, and features of Bulldozers. Detailed specifications of all Cat Bulldozers made for tract type and wheel type tractors are presented. Bulldozer attachments, such as the brush, root and rock brakes, the tree-dozer and the stumper, manufactured by Fleco exclusively for Caterpillar, are discussed in the catalog.

Circle No. 29 on Postcard

Non-Return Valve

A bulletin describing the cushioned single-acting non-return valve is now available from Golden-Anderson Valve Specialty Company. Three different yoke assemblies on the elbow, angle and globe bodies are shown in drawings with a list of parts. Adaptability, testing, construction, installation, servicing and specifications are described.

Circle No. 30 on Postcard

Gunite Concrete

Physical characteristics and average results of various tests on Gunite concrete are explained in a bulletin released by Gunite Concrete and Construction Company. Advantages of the product over other methods of concrete placement and the application of Gunite concrete through illustrations are presented.

Circle No. 31 on Postcard

Conversion Tables

Hardness conversion tables for steels have been released by The International Nickel Company, Inc. Printed on celluloid cards, wallet size, the table gives approximate relationship between Brinell, DPH (Vickers), Rockwell and Shore Scleroscope hardness values and corresponding tensile strengths of steels.

Circle No. 32 on Postcard

Technical Charts

A service for supplying roll and dial charts to industry has been developed by Technical Charts, Inc. Where once it was necessary to order recording charts from many different instrument makers, now all recording roll and dial charts can be ordered from one source. A new brochure describing this service is available.

Circle No. 33 on Postcard

Shovel-Cranes

The Link-Belt Speeder Corporation has published a catalog describing its 51 Series shovel-cranes including the crawler-mounted LS-51, the truck-mounted HC-51 and the wheel mounted MS-51 models. Comprehensive data covering the upper machinery, crawler, truck and wheel-mounted lower mechanisms for each model are shown.

Circle No. 34 on Postcard

Power Distribution Practices

A guide for plant engineers on electric power distribution practices in large and small plants is available from the General Electric Company. The publication covers utility distribution practices, methods of buying electric power, what to do when a choice of primary voltage is available, application of primary switches and circuit breakers and types and arrangements of primary cables.

Circle No. 35 on Postcard

Data Systems

Applied Science Corporation of Princeton has released an illustrated booklet discussing data systems and components, radio telemetering and its applications in power and fuel distribution systems, guided missile research, remote measurement for vehicle operation and navigation, flood and irrigation control, and production and manufacturing processes. Views of the company's research and production facilities are included.

Circle No. 36 on Postcard

Gear Type Couplings

Seven major engineering advantages of fully crowned teeth in gear type flexible couplings are described in a bulletin by the American Flexible Coupling Company. Applications of Amerigear Couplings for problems such as excessive offset or angular misalignment, space limitations, high speeds and torque loads are illustrated.

Circle No. 37 on Postcard

Save time! Keep informed! Circle numbers on postcard, page 307

News of Men in the Industry

E. V. **Hewitt,** operating vice president of Pan American Production Company, has been elected vice president and appointed general manager of operations of Pan American Gas Company. Hewitt joined the Pan American companies in 1935 as a field foreman for Pan American Production Company and in 1937 was promoted to assistant general superintendent and later to general superintendent. Hewitt was elected a vice president of Pan American Production Company in charge of field operations and administrative matters in connection with his department in 1951. In the management of operations Hewitt replaces Albert C. (Court) Golden, Jr., who resigned as manager of Pan American Gas Company to become vice president—operations of Pan American Pipe Line Company.

E. V. Hewitt

•

Herbert T. McMeekin, Jr., formerly economist for Deep Rock Oil Corporation, Tulsa, and recently assistant to the vice president of the company's Land and Exploration Division, resigned to join the Oil department of Loomis, Sayles & Company, Inc., investment counselors, Boston, Mass.

•

W. E. (**Gene**) **Powell** has joined Husky Oil Company's subsidiary, Husky Oil & Refining Ltd. as manager of exploration. Before serving as manager of Canadian operations for the Seaboard-Honolulu-Sunray oil group in Canada, Powell was with Barnsdall Oil Company for 22 years.

•

Frank Lemmond, formerly with Loffland Brothers in Oklahoma and West Texas, has been named drilling superintendent with Darrell W. Smith, rotary workover contractor at Midland, Texas. Lemmond formerly was assistant superintendent for Harold Carmack in the Rocky Mountain area and later took over Zephyr's rigs in the Permian Basin.

•

R. L. Wales has been promoted to assistant division manager of the Oklahoma Division of The Texas Company's Producing department. Wales was assistant to the manager of the Geophysical division in charge of geophysical operations in Canada. In his new job Wales will have headquarters in Tulsa, where he replaces **Harvey Cash,** who has been transferred to the company's Foreign Operations department in New York. Wales joined the company in 1936 and has served in South Texas, the Rocky Mountain areas and Canada.

•

C. M. Lyon has been named manager pro tem of capital stock recording in the general office of Standard Oil Company at Chicago. Lyon replaces **A. K. Hermes,** who is on sick leave. **Leroy Hoff** has been appointed assistant manager pro tem to replace Lyon.

Floyd Brett has been appointed general superintendent of production of Sinclair Oil & Gas Company. Brett's headquarters will remain in Tulsa where he has been assistant general superintendent of production for the past 2½ years. A graduate of Oklahoma A. & M. College, Brett joined Sinclair in 1929 in the Gasoline department, moving to production as an engineer in the East Texas field in 1933. From 1936 until 1940 he was engineer, district foreman and district superintendent at various locations in West Texas and New Mexico and returned to East Texas in 1940 as district superintendent. Later he served as assistant division superintendent at Fort Worth and assistant general superintendent in Tulsa. Brett was on leave of absence in 1951 to serve as assistant director of production of the Petroleum Administration for Defense, Washington, D. C.

•

Paul D. Neuenschwander, acting district landman for Sohio Petroleum Company at Lewistown, Mont., has been made district landman for the Lewistown district covering Montana and North Dakota. Neuenschwander joined Sohio as a junior geologist in July, 1948. He has been associated with the Casper, Wyo., office of Sohio in the Rocky Mountain district as scout, landman and titleman and was attached to the Montana office as landman and titleman in 1951.

•

I. J. Brook, special land representative for Union Producing Company, Shreveport, La., has retired after 27 years with the company.

•

Jay C. McWilliam, Ville Platte, La., North Louisiana district production superintendent for Continental Oil Company, has been appointed East Texas district production superintendent. **Kenneth M. Hammond,** Houston, a member of Continental's southern region production staff will succeed McWilliam at Ville Platte. McWilliam joined Conoco in 1937 at Tepetate, La. He held supervisory positions at Lance Creek, Wyo., and Ville Platte natural gasoline plants before his promotion to North Louisiana district production superintendent in 1950. Hammond became associated with the company in 1929 at Fort Collins, Colo. He held production positions in Colorado and Wyoming and was Wyoming district production superintendent before transferring to Houston in 1950.

•

Peter Black has been appointed assistant to the president of Freeport Sulphur Company. A Harvard graduate, Black was until recently assistant director of the Office of Defense Mobilization.

•

W. C. Koger of Great Bend, Kansas, has been named head of Cities Service Oil Company's oil production division corrosion and oil treating section. Koger has worked in the company's research laboratory at Okmulgee, Okla., and in the oil production division at Great Bend. He served as corrosion and oil treating engineer at Great Bend.

A. A. Anders, Tyler, East Texas district production superintendent for Continental Oil Company, has been promoted to West Texas-New Mexico division production superintendent with headquarters at Midland. Anders succeeds **Harry Miller** who has been transferred to Oklahoma City as assistant production manager of Conoco's central region.

•

George S. Buchanan, formerly vice president in charge of land and exploration for the Sohio Petroleum Company, Houston, has joined Husky Oil Company as director and vice president—exploration. A graduate of the University of Michigan, Buchanan received his M.S. degree at Michigan in 1924. Directing land and exploration activities for Sohio Petroleum in the United States and Canada, Buchanan also served Sohio as operator's representative in Canada for a group of six associated companies. Prior to joining Sohio in 1945, he was president of the Adams Louisiana Company and the Yegua Corporation.

George S. Buchanan

•

Eugene L. Earl has been appointed vice president and manager of Louisiana exploration for Monterey Exploration Company, San Antonio. Earl will have headquarters in New Orleans. Formerly Gulf Coast division geologist for British-American Oil Producing Company, Earl is a University of Texas graduate.

•

R. E. Bounds has been named Louisiana division land man of Monterey Exploration Company. Bounds formerly was Louisiana district land man for the California Company. He received his bachelor and law degrees from Louisiana State University.

•

William Doyle has been promoted by Tide Water Associated Oil Company and in his new job Doyle will handle export transportation booking and scheduling.

•

Murray J. Wells, division geologist for Cities Service Oil Company at Casper, Wyo., has been named division manager of exploration for the northwest division with headquarters at Casper. Wells will continue to act as division geologist.

•

C. A. Peterson, Pacific Coast area treasury manager for Shell Oil Company in Los Angeles, received a diamond studded pin in recognition of 30 years of service with the company.

•

W. A. Petersen, geologist for Continental Oil Company at Corpus Christi, has been promoted to division geologist. Petersen replaces R. T. Short, recently promoted to southern regional geologist with headquarters in Houston.

Reese H. Tucker, manager of the land and geological division of Cities Service Oil Company (Del.), has been elected a director of the company.

•

Earl D. Wallace, director and vice president in charge of production for The Standard Oil Company of Ohio, has resigned to assume a new post as petroleum advisor to Dillon, Read and Company, New York.

•

Dr. Robert C. Spivey has joined Shell Oil Company's Pacific Coast area exploration staff in Los Angeles as senior geologist. Spivey started with Shell in Texas in 1940 and for the past four years has been area stratigrapher in the Midland, Texas, area.

Richard R. Evans, production engineer for Sunray Oil Corporation, has been transferred to Premont, Texas. Evans formerly was at Yorktown, Texas.

•

E. H. Wood, Jr., has been appointed to head the new district office of Warren-Bradshaw Exploration Company at Wichita, Kan., handling activities in Kansas and the Julesburg Basin. Formerly Wood was with Vickers Petroleum Company in Wichita.

•

Warren L. Baker, editorial director of WORLD OIL, has been named to the executive committee of the Associated Business Publications' National Conference of Business Paper Editors.

Charles A. Perlitz, Jr. **Ira H. Cram**

E. F. Battson, administrative vice president of Continental Oil Company, has been elected chairman of the executive committee of the board of directors. Other promotions announced at the same time were **Charles A. Perlitz, Jr.,** vice president, and **Ira H. Cram,** vice president — exploration, both named to the newly-created positions of senior vice presidents. Battson will have headquarters in New York while Perlitz and Cram will continue to reside in Houston. Battson succeeds George Whitney and will continue as a vice president of the company. He has been with Conoco for more than 30 years. Perlitz joined the firm as general attorney in 1946 and was elected vice president the same year. Formerly with The Pure Oil Company, Tulsa, as division geologist, assistant chief geologist, and manager of exploration, Cram joined Conoco as vice president-exploration in 1949 and was elected a member of the board of directors in March, 1952.

E. F. Battson

•

John S. Cruse, Jr., is no longer associated with the James D. Hancock interests in Dallas, where for the past 16 months he has been consulting geologist for Hanco Oil and Gas Company, Ltd. Cruse formerly was with Amerada Petroleum Corporation in Houston and Tulsa for 18 years in various positions in the Geological department.

•

W. L. Thompson has been promoted to assistant director of research and development of Mid-Continent Petroleum Corporation. A graduate of the University of Minnesota, Thompson joined Mid-Continent in 1926 as chemist and was promoted to assistant chief chemist and later to chief chemist.

•

W. L. McKinnon, has been apppointed manager of the research laboratory of the recently reorganized Exploration and Production Research Division of Shell Development Company in Houston. Other appointments include **C. H. Fay,** manager of the Physical department; **W. R. Purcell,** manager of the Chemical department; and **R. J. LeBlanc,** manager of the Geological department.

•

W. P. Orr, senior petroleum engineer, Hawkins District, was promoted to district petroleum engineer at the Palestine District, East Texas Division, by Humble Oil & Refining Company.

An almost unbelievable increase in Wire Line service has been achieved on the "big" rigs by the use of larger diameter drilling lines.

In 1947 when the Anchoring Weight Indicator combination was designed, the manufacturers anticipated the broader use of large diameter drilling lines and built the Type "E" Weight Indicator and the Type "E" Wire Line Anchor.

The "E" Anchor was designed with 30" diameter drum and the Weight Indicator and Anchor were designed for a dead line load of 90,000 lbs. When the trend to "big" lines took hold, the Type "E" combination was ready. No ordinary Weight Indicator or Anchor is suitable for such service . . . either in capacity or design.

Of course, the Weight Indicator reads directly in thousands of pounds. It shows net weight on the bit. It is unaffected by temperature changes or changes in fluid volume. Small volumes of air in the system do not affect its accuracy.

No adjustments are necessary, either for different diameter cables or number of lines strung.

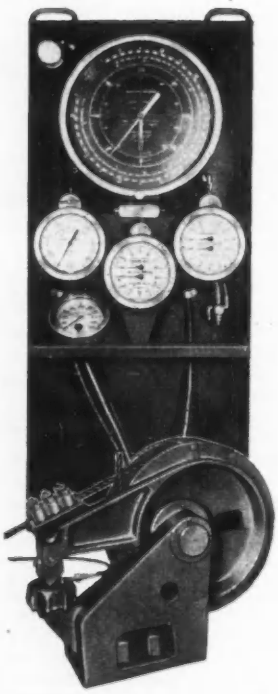
Hundreds of "D", "E" and "F" Wire Line Anchor installations are in use and not a single mechanical failure has been reported since they were introduced in 1947.

Once the anchor is installed, it can virtually be forgotten. When moving the drilling line to change the wear point, most operators do not even lay the blocks down. The Wire Line Anchor clamp is loosened and, in a few minutes, the desired amount of cable is fed over the drum, using one of the clamp studs as a brake.

All these features add up to convenience and saving to the operator who uses the Martin-Decker Type "E" Weight Indicator and Wire Line Anchor combination.

"Big" lines need "big" Weight Indicators and "big" Wire Line Anchors, and you get the capacity and sturdiness you need with the Type "E".

Write for descriptive literature!



The Type "E" Martin-Decker Weight Indicator and IDEAL *Wire Line Anchor.*

HOME OF THE WEIGHT INDICATOR

MARTIN DECKER CORP.

LONG BEACH, CALIFORNIA

SAN JOAQUIN VALLEY — J. J. CULLEN, BAKERSFIELD, CALIFORNIA
MID CONTINENT DISTRIBUTOR, REED ROLLER BIT COMPANY, HOUSTON, TEXAS
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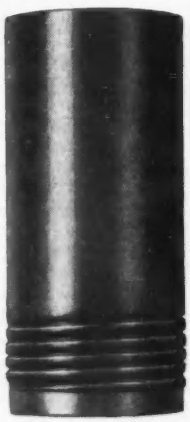
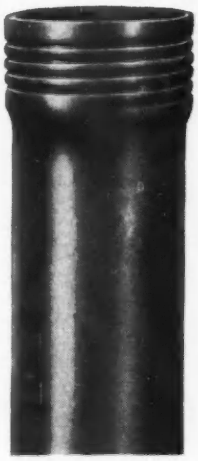
MARTIN-DECKER WEIGHT INDICATORS AND IDEAL WIRE LINE ANCHORS ARE ALSO SOLD THROUGH THE NATIONAL SUPPLY EXPORT CORP., THE NATIONAL SUPPLY CO. AND OTHER RECOGNIZED SUPPLY HOUSES.

J&L STEEL

SHOT HOLE CASING

Faster, more convenient, more economical for seismograph crews





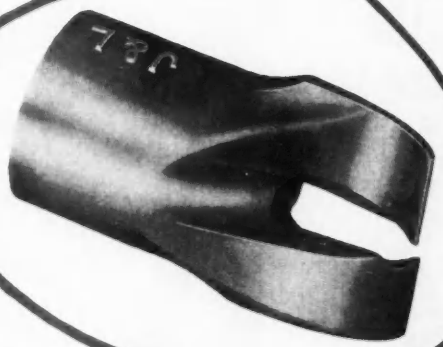
In most formations you can drill with the casing. It has high torsional strength.

It is light, easy to handle. 3" O.D. weighs only 2.037 lbs. per foot. 4" O.D. weighs only 2.732 lbs. per foot. Furnished in uniform 10' to 20' joints.

Rolled threads with 15,000 lbs. pull out strength average.

Integral joint; no independent couplings.

Available quickly, anywhere. 'Phone your J&L store.



This inexpensive, expendable bit has threads to match the casing. Large water course. Fast-cutting fishtails. Drilling and setting in one operation saves time and money where formations are favorable.

PESA

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M. E. Spaght

A. J. Galloway

M. E. Spaght and **A. J. Galloway**, executives of Shell Oil Company in New York, have been elected to the board of directors of the company. Spaght, formerly president of Shell Development Company, the research affiliate of Shell Oil, was recently appointed executive vice president of Shell Oil. Galloway is vice president in charge of the company's exploration and production activities in the United States and Canada.

•

A. W. (Tommy) Thompson, president of Thompson-Carr, Inc., drilling contractors, was elected by members of the Texas Employers' Insurance Association to the association's board of directors at the organization's annual meeting February 26 at Dallas.

•

George B. Holden has resigned from the Department of Conservation of the State of Louisiana, in Baton Rouge to open an office in Baton Rouge as a petroleum consultant.

Transfers and Promotions

Sinclair Oil & Gas Company has announced the following promotions and transfers: **C. C. Confer**, junior petroleum engineer at Sand Draw, Wyo., is transferred to Big Spring, Texas. **Paul Davis, Jr.**, junior petroleum engineer at Odessa, Texas, transferred to Arp, Texas. **James A. Shelton**, intermediate petroleum engineer at Midland, Texas, transferred to Wink, Texas. **Lloyd W. Biddick**, junior petroleum engineer at Arp, Texas, is transferred to Big Spring, Texas. **Byron L. Plumley**, intermediate petroleum engineer at Ardmore, Okla., transferred to Bairoil, Wyo. **Stephen F. Devore**, division engineer at Casper, Wyo., transferred to Independence, Kansas. **Gene L. Weger**, division engineer at Oklahoma City, transferred to Casper, Wyo. **Joe Mefford**, district foreman at Hobbs, N. M., promoted to assistant district superintendent and transferred to Pampa, Texas. **Joseph J. Wright**, intermediate petroleum engineer at Big Spring, Texas, promoted to assistant district foreman and transferred to Monument, N. M. **Harold W. Shaner**, district foreman at Big Spring, Texas, transferred to Lovington, N. M. **Lindel G. Buchanan**, junior petroleum engineer at Oklahoma City, transferred to Homestead, Fla. **A. N. Hope**, district foreman at Arp, Texas, transferred to Wewoka, Okla. **David G. McMunn**, junior petroleum engineer at Kiefer, Okla., transferred to Oklahoma City. **Wayne J. Hixon**, assistant district foreman at Stroud, Okla., transferred to Covington, Okla. **John H. Heft**, assistant district foreman, at Covington, Okla., transferred to Stroud, Okla.

•

Magnolia Petroleum Company has announced the following promotions in the producing division: **M. M. Keeble**, district superintendent of the Kermit producing district, to district superintendent in the newly-created district known as the Sacroc Two district in the Snyder, Texas, area; **J. M. McLaughlin**, assistant district superintendent of the Brownfield producing district, to assistant district superintendent of the Sacroc Two district; **E. G. Blundell**, from assistant district superintendent to district superintendent of the Kermit district; **Robert W. Lewis, Jr.**, assistant division petroleum engineer at Midland, Texas, to assistant district superintendent at Kermit; **J. H. Brewer**, producing foreman in the Pegasus producing district in West Texas, to assistant district producing superintendent of the Brownfield district; **Hillard Greenwood**, from production gang pusher to assistant foreman in the Duncan district; **Cyrus O. Turner**, assistant foreman at Duncan, to production foreman at Kermit; **Marion W. Lovelace**, from assistant foreman to production foreman in the Pegasus district; **Albert W. Shaw, Jr.**, petroleum engineering assistant in the Kermit district, to assistant production foreman in the Pegasus district; **Ernest B. Etheridge**, assistant foreman to production foreman in the Shreveport producing district; **Lavis C. Chance**, gang pusher in the Rusk producing district in East Texas, to assistant foreman in the Shreveport district; and **Benjamin F. Dufield, Jr.**, from production pumper to assistant foreman in the Louisiana-Gulf producing district.

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*PLASTIC LEAD SEAL

FOR CASINGS, DRILL COLLARS, BIT JOINTS, CHRISTMAS TREES AND OTHER THREADED CONNECTIONS

"John Crane" Plastic Lead Seal is the Petroleum Industry's favorite all-purpose joint and thread compound. Easily applied – insoluble in *all* petroleum products – PLS never hardens – won't crack due to temperature changes – gives lasting protection against gall and rust. Leakproof connections are assured – even under abnormally high operating pressures. Joints may be easily broken after years of service. Available in 1, 5, 14 and 28-lb. pails. See your local oil well supply store.

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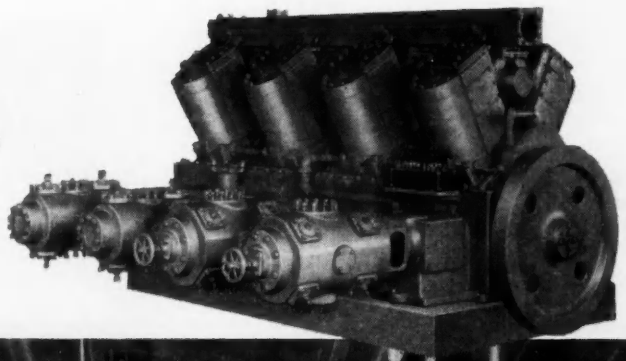
at Snyder Plant of

STANDARD OIL COMPANY of TEXAS



7 VETERAN (16 years old) XVG's + 8 MODERN SVG's = 5340 hp of trouble-free casing head gas compression

The 15 Ingersoll-Rand gas-engine-driven compressors shown above include seven XVG units which have been in almost continuous operation since 1936 . . . plus eight modern-design SVG units. The XVG's were moved to Snyder Plant in West Texas from an old plant in Ward County, requiring remarkably little work at the time of relocation.

Old and new units alike are all giving *excellent service*, compressing casing head gas to 465 psig pressure for delivery to the absorbers.

The seven XVG's are rated at 260 hp each and the eight SVG's at 440 hp each—a total of 5340 hp.

Ask your Ingersoll-Rand representative for complete information on gas-engine compressor performance and economy.

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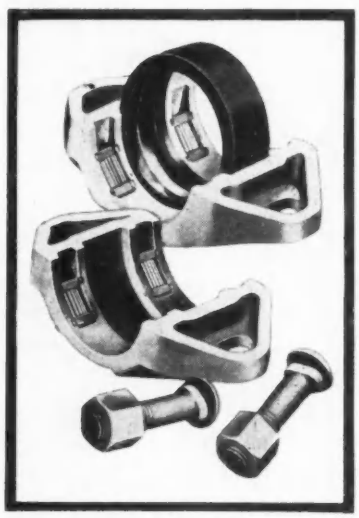
the coupling for plain end pipe

At this pipe line outlet, and in scores of drilling, producing, and refining installations, you'll find Rolagrip couplings for plain end pipe used throughout. Rolagrips are a "natural" for the petroleum industry — tight and leakproof . . . easy to put on and take off . . . flexible . . . automatically "cushioned" against end pull, vibration, shock, expansion and contraction.

And remember—no grooving, threading, flanging, or welding is necessary when you use Rolagrips. Try some from your favorite local supply store, where Rolagrips are available in sizes 1½" to 12". (If the job calls for grooved pipe, ask for Gruvagrip couplings and Gruvagrip fittings.)



GUSTIN-BACON MANUFACTURING COMPANY

210 W. 10th St., Kansas City, Mo.

DEATHS

H. H. Messimer, 74, of Tulsa, head of one of the few tank gauging companies in the country, died February 16.

•

Ed W. George, 58, agent for The Carter Oil Company in the Legal department, died February 16 at his home in Tulsa.

•

Virgil Marshall, 56, general auditor for The Skelly Oil Company, died February 10 in Tulsa.

•

William Arthur (Cherry) Smith, 56, district foreman for Mid-Continent Pipe Line Corporation, died February 12 at his home in Drumright, Okla. Smith had been with the company for 25 years.

•

William H. Correa, former assistant to the president of Socony-Vacuum Oil Company, Inc., died February 15 in Cleveland. Correa began work with Standard Oil Company of New York in 1908 and received several promotions. He was elected a director of the company in 1931. In 1933 Correa became general manager of Socony-Vacuum's Lubrication department and became assistant to the president in 1945. Correa retired several years ago.

•

C. E. Artz, Jr., independent oil operator, died in Houston February 28.

•

Clayton E. Dial, 56, independent oil operator of Bristow, Okla., died February 25.

•

Jess R. Vandaveer, 67, retired pipe line stringing company owner, died February 25 in Kansas City, Mo. Vandaveer resided in Neodesha, Kansas, and owned one of the four major pipe line stringing companies in the United States until his retirement in 1950.

•

Joseph Loriaux, 87, independent oil producer, died February 20 in Bartlesville, Okla. A native of Belgium, Loriaux had resided in Bartlesville since 1914.

•

J. Fred Darby, 80, oil operator of Tulsa and Muskogee, Okla., died February 28 at his home in Phoenix, Ariz. Darby was president of Darby Petroleum Corporation, Darby-Lynde Co. and Western Oil Corporation, as well as director of the Oklahoma Natural Gas Company and Darby and Bothwell, Inc. Darby also was the first president and one of the organizers of the Mid-Continent Oil and Gas Association, Tulsa.

•

John M. Cline, 43, drilling contractor and oil producer of Wetumka, Okla., and Mt. Carmel, Ill., died February 25.

•

Marshall Moore, oil field contractor, died in Lafayette, La. on February 28. Moore formerly was with Byron Jackson Company in Houston for 17 years.

•

Daniel B. MacDaniel, 66, retired Houston oilman, rancher and automobile dealer, died March 4 in Los Angeles.

Companies In the News

GREAT AMERICAN OIL COMPANY has acquired an interest in the **SUNSET OIL COMPANY,** independent oil producers, refiners and pioneer West Coast distributors and retailers of petroleum products marketed under the Golden Eagle brands. Sunset Oil is embarking on an extensive expansion program involving refinery enlargement and expanded exploration and oil producing activities, the officers announce. **B. L. Majewski,** president of Great American Oil Company in Chicago, has been elected a member of Sunset Oil's board of directors. Majewski is a director of the API and of the Independent Petroleum Association of America.

•

OKLAHOMA NATURAL GAS COMPANY has been awarded a certificate of management excellence for 1952 by the American Institute of Management, New York. Of 3000 leading firms studied, 330 companies in the United States and Canada received the award.

•

C. B. ANTILL AND COMPANY, engineers and constructors, have opened a new office at Corpus Christi, Texas. The company maintains offices in New York and Toronto, Edmonton and Calgary, Canada.

•

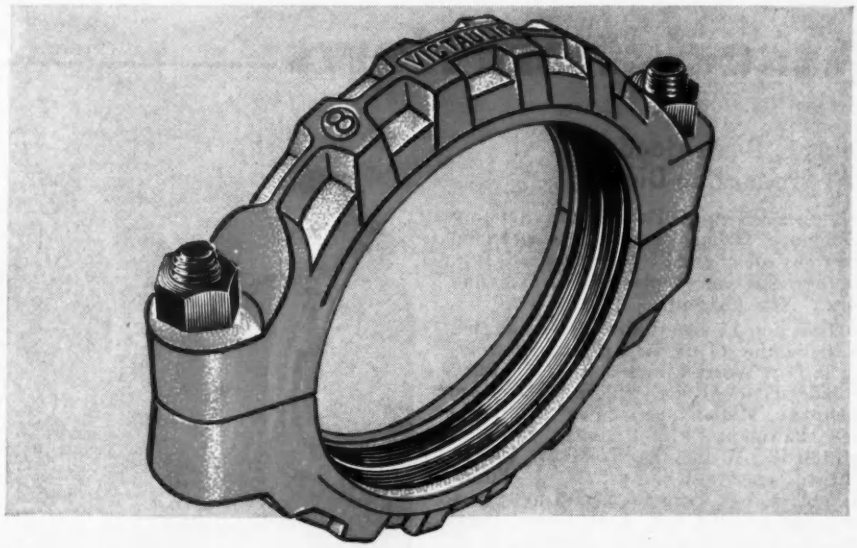
STANOLIND OIL AND GAS COMPANY'S new research center in Tulsa is expected to be completed in the spring. Structural work on the four buildings is finished and work is progressing on interiors of the buildings with installation of mechanical, electrical and air conditioning equipment. New laboratory equipment also is being installed to augment present facilities. All of Stanolind's research and technical activities will be transferred to the new center. Located on an 80-acre tract of land, the center will be composed of a main office and laboratory building, a service and maintenance building, a pilot plant and heavy experiment laboratory building. **Paul Lorenz** is Stanolind's architectural engineering supervisor and **H. A. Waughtal** is the company's project engineer. **George Roberts, Jr.** is manager of Stanolind's Research department.

•

THE CALIFORNIA COMPANY has transferred Utah and Arizona territory operations to the Standard Oil Company of California and Oklahoma to the Standard Oil Company of Texas to obtain a better balanced division of operating territory in the United States between the present company and its domestic exploration and producing subsidiaries. Personnel affected by the transfers have been notified. Employes not notified will remain with The California Company.

•

THE OHIO OIL COMPANY has announced plans for a new addition to the company's general office building in Findlay, Ohio, to meet present space requirements and provide for future expansion. Two floors will be added to one portion of the building and a new eight-floor wing will be constructed.



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Association News

Louis F. Davis Heads API Production Division

Louis F. Davis of The Atlantic Refining Company, Dallas, is the newly-elected chairman of the API Southwestern Production Division replacing E. N. Van Duzee, New Orleans.

Davis and 11 vice chairmen were elected at the closing of the API producers' meeting in Fort Worth March 6. Vice chairmen include Don Miller, Phillips Petroleum Company, Midland, serving as West Texas vice chairman; C. L. Bramlett, Halliburton Oil Well Cementing Company, Corpus Christi, southwest Texas; T. J. Fuson, Humble Oil & Refining Company, Houston, Texas Gulf Coast; J. D. Exner, Humble, Wichita Falls, North Texas; W. S. Crake, Shell Oil Company, Kilgore, East Texas; Ray Elner, Kobe, Inc., Fort Worth, Central Texas; R. K. Guthrie, Selligson Engineering, San Antonio, Balcones Area; Weldon Ramseur, Gulf Refining Company, Laurel, Miss., for Alabama-Mississippi; Raymond L. Meleton, Arkansas Fuel Oil Company, Shreveport, for Arkansas-Louisiana; John E. Shannon, Magnolia Petroleum Company, Lake Charles, southern Louisiana; and Dan Bodie, Cities Service Oil Company, Hobbs, southeast New Mexico.

George Gray, Baroid Sales Division, National Lead Company, Houston, was elected secretary-treasurer of the district and W. B. Duncan, Houston Oil Company of Texas, Houston, was named chairman of the advisory committee.

Underwater Gravity Meter Exhibit

Among the geophysical exhibits in the Hall of Science at the May 14-23 IPE in Tulsa will be an underwater gravity meter operated by remote control. Exhibit chairman W. T. Born, vice president of Geophysical Research Corporation, second from left, is shown explaining the control panel for the device to other members of the group. Left to right are W. B. Agocs, professor of physics and geophysics at the University of Tulsa; Born; C. B. Scott, head of the geophysical engineering section, The Carter Oil Company, and C. K. Ruddick, area manager, Schlumberger Well Surveying Corporation. The device, property of Stanolind Oil & Gas Co., is reported to be the only one of its kind and has been used extensively in off-shore exploration work in the Gulf Coast area.

Kingdoms have been lost because of the lack of minute, special equipment at a critical time.

And so it can be in your business; packings or piston rings that do a specialized job can make the difference between maximum equipment performance or shut downs.

Let our engineers study your packing or piston ring problem and then recommend the right products for your needs.

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- **Power Piston Rings**
- **Carbon-Bakelite Liquid Pump & Compressor Piston Rings**
- **Valve Discs**

FRANCE PACKING COMPANY

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Houston Chapter of Nomads

New officers for 1953 of the Houston Chapter of Nomads are, left to right, H. J. Wood, regent; Ben J. Young, sergeant-at-arms; Joe Lyne, deputy sergeant-at-arms; W. O. Hedrick, assistant secretary; Ed M. Fontaine, president; E. T. Adams, assistant treasurer; W. L. Childs, Jr., treasurer; Madden T. Works, secretary; Ray Doan, vice president; R. K. Franklin, regent; and Harry E. Estes, executive secretary.

Four Corners Society Elects 1953 Officers

The Four Corners Geological Society has announced officers for 1953. They are Jack C. Cooper, district geologist, Continental Oil Company, Durango, Colo., president; Val Reese, district geologist, Phillips Petroleum Company, Albuquerque, N. M., first vice president; Walter Osterhoudt, consulting geologist, Durango, Colo., second vice president; Bill Roberts, Gulf Oil Corporation, Durango, secretary and Otto Brown, district geologist, Gulf Oil Corporation, Durango, treasurer.

Which

SHAFFER CELLAR CONTROL GATE

best meets YOUR requirements ?

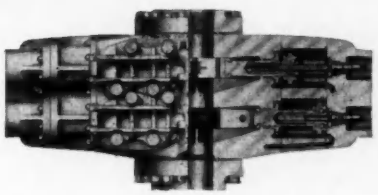
Shaffer—And Only Shaffer—gives you this important selection in pressure control equipment . . . a choice of either Hydraulic or Mechanical operation, plus a choice of either Double (two gate compartments unitized into one compact body) or Single type in both designs!

Still another advantage—if your operations are such that you use both Hydraulic and Mechanical Cellar Control Gates in your field operations, there is no need to stock duplicate rams and rubbers. In Shaffer Gates, rams and rubbers are interchangeable, size for size, between hydraulically-operated and mechanically-operated equipment. This means further savings in inventories, greater simplicity in maintenance.

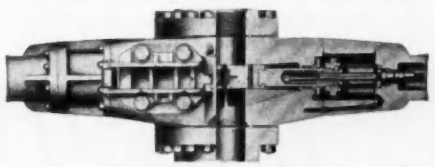
Hydraulic

OPERATION

In these Gates, rams are opened and closed by hydraulic fluid under pressure. Their operating speed, convenience and quick adaptability to various hook-ups make Shaffer Hydraulic Gates ideal for a wide range of modern drilling applications.



The Shaffer Hydraulic Double Cellar Control Gates provide two individually-operated ram compartments unitized into one compact body. Even in sizes as large as 13⅜" (12" Series 900), only 30" overall height is required.



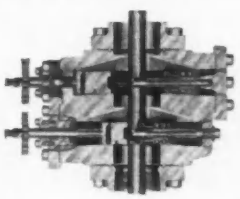
The Shaffer Hydraulic Single Cellar Control Gates may be used singly, or with other Single or Double Hydraulic Gates, to provide one or more ram compartments to meet various operating requirements. This gate requires only 18½" overall height in sizes as large as 13⅜" (12" Series 900).

Both Double and Single Hydraulic Gates provide:—Unmatched simplicity in changing rams by merely opening doors in the gate body . . . completely enclosed design with no exposed moving parts . . . self-draining compartment bottoms . . . direct hydraulic drive without yokes or secondary connections . . . and many other exclusive advantages.

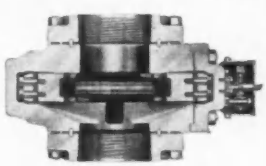
Mechanical

OPERATION

In these Gates rams are opened and closed by synchronized operating screws rotated by a compact motor drive—or manually. Simple and compact, Shaffer Mechanical Gates are very easy to install and are preferred by many operators for certain types of operations.



The Shaffer Mechanical Double Cellar Control Gates provide two separate ram compartments unitized into one compact body. Even sizes as large as 13⅜" (12" Series 900) these Gates require only 28½" overall height.



The Shaffer Mechanical Single Cellar Control Gates may be used singly or with other Single or Double Mechanical Gates to provide one or more ram compartments, as required. Need only 17⅜" overall height even in sizes as large as 13⅜" (12" Series 900).

In both Double and Single Mechanical Gates, rams can be changed by removing only one end cover . . . compartment bottoms are self-draining . . . well pressure is used to assist the sealing operation . . . and there are many other advantages.

See the Shaffer section of your Composite Catalog.

Write for your free copy of the new 1953 Shaffer Catalog.

For full details on the many far-reaching advantages built into Shaffer Cellar Control Gates—and other Shaffer products—see your nearest Shaffer representative. Or write direct!

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Desk and Derrick Officers

Committees of the Association of Desk and Derrick Clubs of North America met recently in Fort Worth to discuss organization and standing committees. Attending the meeting were, seated left to right, Miss Margaret Neff, Dixie Geological Survey, Jackson, Miss., national president; and Miss Olive Filteau, Gulf Oil Corporation, immediate past president of the Fort Worth chapter. Standing are Miss Dorothy Kassel, Kobe, Inc., Fort Worth chapter president, and Mrs. Irene Cox, Panhandle Producing Company, San Antonio, national first vice president.

Senator Wiley to Speak At LP Gas Convention

U. S. Senator Alexander Wiley of Wisconsin, chairman of the Foreign Relations Committee, will be the principal speaker at the 1953 convention and trade show of the Liquefied Petroleum Gas Association in Chicago on May 4.

Other program speakers include Mort Farr, immediate past president of the National Appliance and Radio-TV Dealers Association; Cal Tinney of Tulsa, commentator and humorist of radio and television; and Donald M. Hobart, vice president and director of research for the Curtis Publishing Co., Philadelphia.

Latest liquefied petroleum gas appliance and equipment will be exhibited May 5 and 6. Industry sectional meetings are scheduled May 6.

API Safety and Fire Committees To Hear Ernest O. Thompson

Lieut. Gen. Ernest O. Thompson of Austin, chairman of the Texas Railroad Commission, will be the principal speaker at the sixth mid-year meeting of the API Safety and Fire Protection Committees in Galveston, April 27-May 1.

Thompson's topic will be, "America's Petroleum Supply, Our First Line of Defense." B. G. Crane of the Du Pont Company is chairman of the program committee.

Meetings of 20 safety and fire protection committees are scheduled. Subjects to be discussed include tank cleaning, pipe line safety, fire protection in natural gasoline plants, fire protection engineering and regulations, safe marketing practices and safety in drilling and production operations.

FOR SWABBING

AUTO-RELEASE WIRE LINE STRIPPER

Finest in the field. King Strippers represent outstanding advances in design and construction that assure long life and maximum operating efficiency:

- POSITIVE LATCH will not release by accident or surge of pressure.
- SURE RELEASE MECHANISM operated by rope socket striking bottom of the stripper.
- NON-SPARKING MATERIALS minimize fire hazard.
- ROLLER WIRE LINE GUIDES on hardened steel pins.
- SIDE OPENINGS for inserting packing while line is in the hole.
- PACKING IS SELF-CENTERING; compression screws need not be evenly adjusted.

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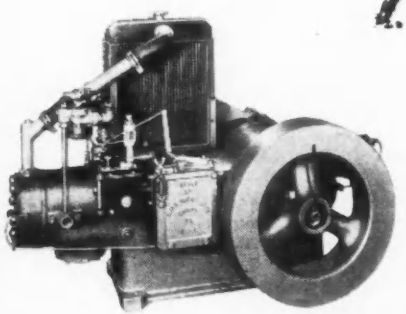
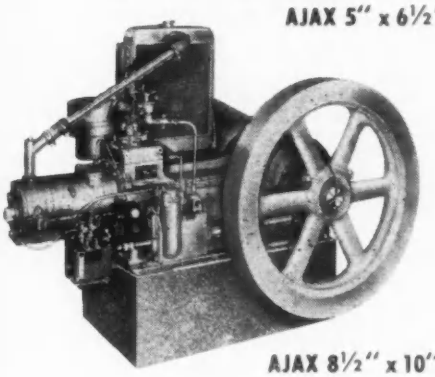
Make the PITTSBURGHER your stopping place on every motor trip. Located right in the heart of town . . . easily reached from all major highways. Enjoy the finest in modern facilities, too . . . 400 rooms each with free radio, bath and circulating ice water; 125 rooms with television. Garage service.

a Knott Hotel

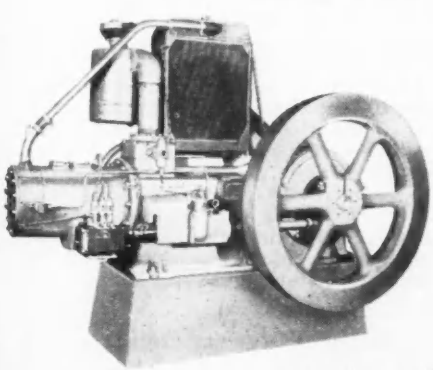
JOSEPH F. DUDDY, MANAGER



AJAX 5" x 6½" WL



AJAX 8½" x 10" CMA



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The one best answer to your problems of gas engine operation, maintenance and durability is simply "Get an AJAX."

Here is the engine with a heritage of many years of easy starting, easy control, simple maintenance and long useful life—advanced and improved in every feature by AJAX *specialized* gas engine engineering.

Check around. Get the opinions of experienced AJAX owners. Then call your Supply Man for the complete story —soon!

AJAX IRON WORKS

Builders of Gas Engines • Steam Drilling Engines • Industrial Steam Engines

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Oil Field Distributors: THE NATIONAL SUPPLY CO., PITTSBURGH, PA.
R. B. MOORE SUPPLY CO., INC., BOLIVAR, N. Y. • BETHLEHEM SUPPLY CO., TULSA, OKLA.

News of Service and Suppliers

Hughes Tool Company Promotes Three Men in Engineering

Hughes Tool Company has announced the promotion of three employes including Lyle L. Payne to assistant vice president—engineering, R. S. Grant to chief product engineer in charge of the Product Engineering department, and A. P. Farr to assistant chief product engineer.

Payne was graduated from Rice Institue, Houston, and has been with Hughes Tool since 1929. Grant, also a Rice graduate, has been in the Engineering department of the company since February, 1928. Farr was graduated from Oklahoma A. & M. College and joined Hughes Tool in 1937.

Marine Exploration Company Opens New Office in Houston

New offices and laboratories for Marine Exploration Co. have been completed recently in Houston. In the new quarters the company will continue to reinforce all field equipment for maximum strength, and to design, build and test all electronic instruments. Rolling stock is practically rebuilt to enable it to operate in difficult areas. Founded in 1946, Marine Exploration pioneered the use of completely portable seismic equipment.

McCullough Tool Company Opens Branch in Eastern Division

The official opening of McCullough Tool Company's twenty-eighth branch office in the company's Eastern Division took place recently in Magnolia, Ark.

The new facilities will offer all the McCullough services to South and Central Arkansas and to parts of northern Louisiana. John Berley is manager of the new branch office.

Annual Sales Meeting in Dallas

Approximately 200 representatives of The Continental Supply Company attended the thirteenth annual sales meeting in Dallas on March 1-3 at which 76 representatives of Continental's associated manufacturers were present. Participating in the program were, left to right, Harry A. Burdorf, vice president of The Lunkenheimer Company; W. T. Powell, president of Emsco Manufacturing Company; F. M. Mayer, president of The Continental Supply Company; Paul M. Arnall, president of Lunkenheimer, and F. I. Brinegar, executive vice president of Continental. Manufacturers represented were Broderick & Bascom Rope Company; Chain Belt Company; Clayton Mark & Company; Climax Engine & Pump Manufacturing Company; Emsco; Gardner-Denver Company; Ladish Company; Lunkenheimer; New York Belting and Packing Company; Rockwell Manufacturing Company; Technical Oil Tool Corporation, Ltd., and The Youngstown Sheet and Tube Company.

French Manufacturer To Carry Marlow Self-Priming Pumps

Pompes Guinard et Cie, St. Cloud, France, manufacturers of industrial pumps and home water systems, will carry a line of products made by Marlow Pumps, Ridgewood, N. J. Guinard will continue to manufacture single and multiple stage centrifugal pumps, deepwell and gear pumps, but will carry Marlow's self-priming centrifugal pumps.

60 Field Men Enrolled in GSI Correspondence School Training

As part of a continuous training program, Geophysical Service Inc. is offering its personnel correspondence work covering the entire field of siesmic exploration.

Begun in October, 1952, on a strictly voluntary basis, the study program already has an enrollment of 30 students from GSI crews operating in the U. S. From foreign operations, an additional 30 students with Geophysical Service International Corporation, Geophysical Service International S.A. and Geophysical Service Incorporated, bring the total enrollment to 60.

Roy Fuller, GSI correspondence training director, is in charge of the program under supervision of E. J. Stulken, chief seismologist for GSI.

Texas Gulf Sulphur Company Announces Personnel Changes

Texas Gulf Sulphur Company has elected Harry A. Swem vice president of the company. Swem will be manager of production.

Herbert E. Treichler, vice president and general manager, has relinquished his duties as general manager but will continue to serve as a vice president.

Goodyear Promotes Sam Dupree

Sam Dupree, assistant manager of Industrial Products Division of The Goodyear Tire & Rubber Company since 1947, has been named assistant to R. S. Wilson, vice president in charge of sales. Dupree is a graduate of Georgia School of Technology at Atlanta with a degree in mechanical engineering. He joined the Goodyear organization in 1934 on the production training squadron.

Gotkool
water cans
and coolers
GOTKOOL WATER CAN
Made in 1½, 2, 3, 5, 10, 15 and 20 gallon sizes. Push-Button Faucet at slight additional cost.
GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes with Push-Button Faucet.
KEEP PURE DRINKING WATER ALWAYS HANDY
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug-fitting, large, removable top, handy non-leaking push-button faucet. GOTT Water Cans for handy field use. Your supply store has them, get one today!
STANDARD OF THE OIL FIELDS
Insist on the Genuine
Gott
PURE WATER
H. P. GOTT MFG. CO.
WINFIELD, KANSAS

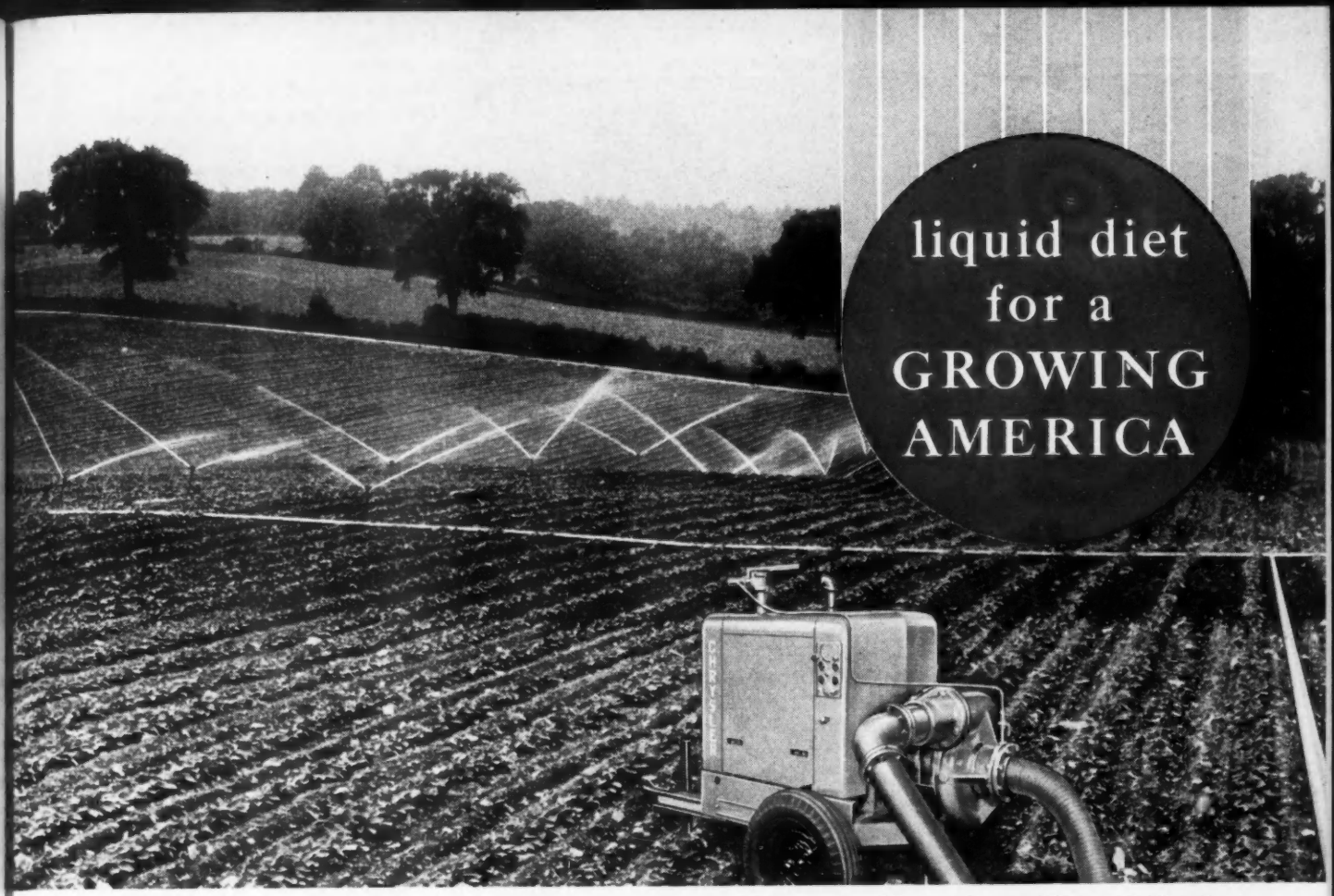


Photo courtesy Marlow Pumps, Ridgewood, New Jersey

nearly 25% more water with Chrysler Industrial Power

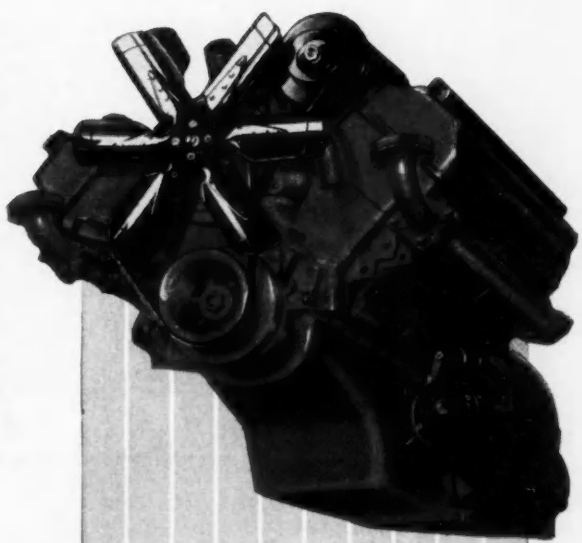
Too seldom does Mother Nature supply moisture in the right proportion for maximum realization of the good things of the soil. This problem is not confined to the so-called "dry" or "arid" regions of the country. For instance, here's a field of beans in upper New York State. This farmer, like many other farmers and growers, has found that a sprinkler system fed by a Chrysler-powered pump provides the supplemental irrigation necessary for best growth.

The Marlow Pump in use here is designed for high capacity pumping. For that reason, the powerful new 180 horsepower, 331 cubic inch displacement Model 20 Chrysler V-8 Industrial Engine was selected to power it. Result: nearly twenty-five percent more water than delivered by pumps powered by engines of similar weight and displacement, *without* sacrificing fuel economy.

This is another fine example of how Chrysler meets the many and varied requirements for industrial power. For instance, Chrysler can equip any of its engines with a corrosion-resistant or fungus-treated electrical system; propane or natural gas burning carburetor; 3, 4 or 5 speed transmission; standard or gýrol Fluid Drive.

Chrysler Industrial Power is not expensive. Production-line methods adapted to specialized industrial engine building provide a custom-built engine at mass-production prices.

For your power needs, see a Chrysler Industrial Engine dealer or write us direct: ***Department 164, Industrial Engine Division, Chrysler Corporation, Trenton, Michigan.***



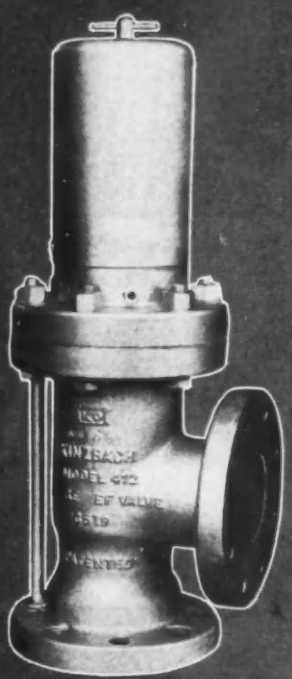
CHRYSLER

Industrial Engines

HORSEPOWER WITH A PEDIGREE

Instant Full-Open Relief of Excessive Pressures

KINZBACH
Model 412 Relief Valve



Among the design features that have brought about the immediate acceptance of the Model 412 Valve with pipeline and refinery engineers everywhere is its ability to open instantaneously to full capacity when the pressure overload in the line is reached, thus providing maximum relief when it's most needed.

Other important features include Automatic Resetting, at a pre-determined pressure drop, Positive Seating, and facilities for Functional Testing.

Model 412 utilizes line pressure for opening and closing. Opening pressure is easily pre-set by the application of a dead-weight load. Action is positive and reliable—the pre-set pressure never changes.

For absolute safety and dependability, use them at strategic points on your hydraulic systems. Available in 2", 3", 4", 6" and 8" sizes, for working pressure up to 1000 p.s.i.

KINZBACH TOOL COMPANY
INCORPORATED

Write for Bulletin RV412 for full technical information.

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HOUSTON, TEXAS
Export Office:
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KINZBACH TOOL CO INC

Martin Elected Vice President Of United Geophysical Company

L. A. Martin has been elected vice president and chief geophysicist of United Geophysical Company.

L. A. Martin

Martin has been with United since 1946, serving as manager in Venezuela and as manager of foreign operations.

A graduate of the University of California in 1934, Martin later received his master's degree from California Institute of Technology. He spent six years with Shell Oil Company, much of the time on foreign assignments.

Butler Manufacturing Company Names Minneapolis Sales Staff

Butler Manufacturing Company has announced three new appointments to its sales organization in Minneapolis. James D. Harmon, Jr., was appointed Oil Equipment sales manager for the division and Albert J. Campbell was named his assistant. In addition Dale B. Horlitz was added to the staff as city sales representative.

Harmon joined the company in Kansas City in 1946 in the Sales Engineering department, and was transferred to Minneapolis in 1951. He is a mechanical engineering graduate of the University of Missouri.

Campbell joined the company in 1935, advancing from office boy to city desk to city salesman. Horlitz, who joined Butler Manufacturing Company in 1947, spent 14 years prior to that time in sales work with the Wood River Refining Company. He is a graduate of the University of Minnesota.

H. K. Porter Company, Inc., Elects Kemper, Vice President

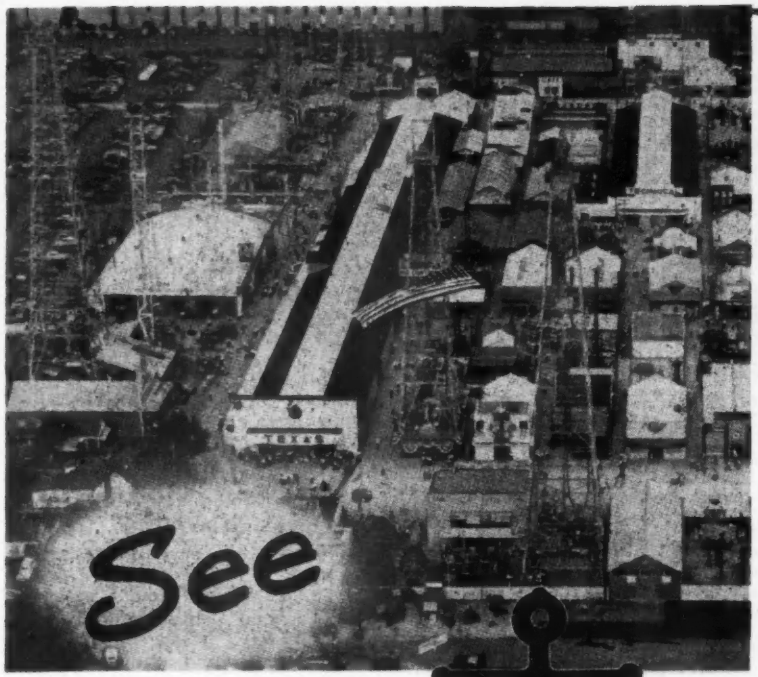
Jackson Kemper has been elected vice president of the H. K. Porter Company, Inc., but will continue his present capacity as general manager. Operating and sales activities of the Watson-Stillman Fittings Division of the company are under his direction. A graduate of Hobart College, his background includes various engineering and sales positions with Yarnall-Waring Company, American Chain and Cable Company and Birdsboro Steel Foundry and Machine Company.

To Manufacture 72-Inch Belts

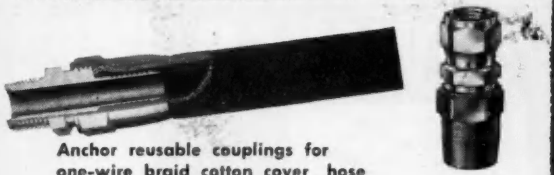
Quaker Rubber Corporation recently completed a $250,000 belt department expansion. The installation included a 72- and 60-inch conveyor belt press. Quaker's largest size to date had been a 48-inch belt.

Honeywell Elects Glenn Seidel

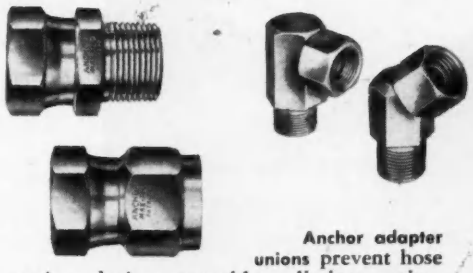
Glenn E. Seidel has been elected a vice president of Minneapolis-Honeywell Regulator Company and will be in charge of engineering at the Minneapolis plants. Seidel has been with Honeywell since 1943 and has been director of the expanding ordnance division for the past 18 months. Before that he served as assistant to W. J. McGoldrick, vice president-engineering.



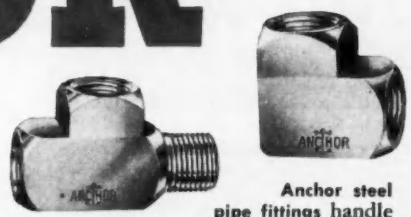
ANCHOR at the Oil Show



Anchor reusable couplings for one-wire braid cotton cover hose let you make fast repairs in tough oil-field service. Only tools required to assemble couplings and hose are a vise, oil can, and wrench. Leak-proof and blow-off proof. Reduce hose assembly inventory.



Anchor adapter unions prevent hose strains during assembly, eliminate pipe-threaded joints. Unions are neat, efficient — simplify piping jobs.



Anchor steel pipe fittings handle maximum working pressure of 3500 psi. Copper-brazed—united in strong, solid piece. Neat, easy to install in confined spaces.

Anchor ductile-sleeve hose couplings for high-pressure work. Exclusive, patented grip virtually makes coupling part of reinforcing wire of hose — ends leaks and blow-offs.

NEW!
REVOLUTIONARY
SPLIT-FLANGE CLAMP
eliminates threaded joints, assembles with small automotive-type wrench. Leakproof — no wedging action to cause stresses or strains.

D-18

for hydraulic hose assemblies, adapter unions, and pipe fittings that are safer, longer-lasting, dependable

Come to *Booth No. 69* in the Texas Building at the International Petroleum Exposition, Tulsa, May 14 through 23. There you'll see why it's easy to get top-flight hydraulic-line performance in oil-field service when you specify Anchor. Anchor gives you the most complete line of hydraulic hose assemblies, adapter unions, and pipe fittings available anywhere — the component that fits each of your jobs exactly. Look at the features of these units that mean safer, more dependable fluid-power transmission for you — wherever oil-field equipment is used.

ANCHOR COUPLING CO. INC.

LIBERTYVILLE, ILLINOIS

Factory Branch: Dallas, Texas *Factory Branch: Detroit, Michigan*

Find out how the Anchor line can save you time, trouble, and money — no matter what branch of oil-field work you're in. Get the complete story at Booth No. 69 during the Oil Show.

WATCH

FOR THE *MOST STARTLING RIG* IN DRILLING HISTORY!

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TULSA OIL SHOW
MAY 14th to 23rd

Wilson
MANUFACTURING CO., INC.

SECONDARY MODERN RECOVERY

TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

Water Flooding
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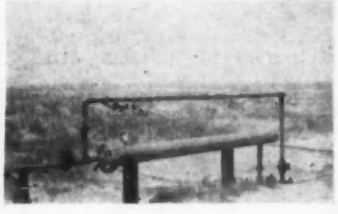


Karnes County,
Texas

REPRESSURING WITH GAS OR WATER

SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE ENGINEERING
WICHITA FALLS, TEXAS

New Officers of California Firm

Recently elected officers of Web Wilson Oil Tools, Inc., Los Angeles, Calif., are, left to right, W. W. (Web) Wilson, board chairman; W. A. Wilson, president; B. M. Landis, vice president, and John W. Rife, secretary-treasurer.

U. S. Steel Names Ralph W. Seely General Manager of Western Unit

Consolidated Western Steel Division of United States Steel Corporation has named Ralph W. Seely, vice president and general manager. Seely was vice president and assistant to the president of the division, with responsibility for engineering, estimating, industrial relations and related functions. Seely joined Consolidated Steel in 1940 and was transferred to Consolidated Western in 1944. He was elected vice president in 1948.

Hammel-Dahl Adds Atlanta Firm

Hammel-Dahl Company, manufacturers of automatic control equipment, has appointed Control Equipment Company of Atlanta, as a sales and service representative. The Atlanta firm will cover Georgia, Alabama and Florida. Robert P. Saunders is in charge of the Atlanta branch.

Alexander Joins Cooper

I. W. Alexander, Oklahoma City, has been named sales and service representative in the Oklahoma area for Fred E. Cooper, Inc., Tulsa. For the past three years Alexander has been working with sales and service of oilfield engine accessories exclusively.

Gustin-Bacon Names New Manager For Philadelphia Sales Office

Barth Gilcrist, a Gustin-Bacon Manufacturing Company employe since 1948, has been appointed division manager at Philadelphia. He joined Gustin-Bacon as sales and service engineer attached to the Eastern division and covered accounts in New York, Pennsylvania, New Jersey and Delaware.

He will be assisted by Leonard E. Feitt, presently resident salesman in Pittsburgh.

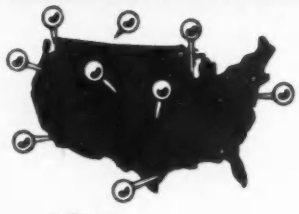
Dorney Joins PAD Metals Branch

Frank Dorney, formerly manager of Tubular Sales for Franklin Supply Company, Chicago, and now on leave of absence from that post, has been appointed chief of the Metals and Minerals Branch of the Materials Division by Petroleum Administration for Defense. He succeeds Paul Shepherd who has returned to his post with Oil Well Supply Division.

Rust-Oleum Appoints Distributor

Rust-Oleum Corporation, Evanston, Ill., manufacturers of rust-preventives, recently appointed The Industrial and Farm Equipment Corporation of Chester, Penn., as a farm and industrial distributor.

NOW coast TO coast



9 Strategic Locations:

Tulsa, Okla., John Watt, Mgr. • **Houston, Tex.**, Boyd Collier, Mgr. • **Denver, Colo.**, W. R. "Bill" Smith, Mgr. • **Chicago, Ill.**, Charles Tewell, Mgr. • **Los Angeles, Cal.**, W. J. "Bill" Parker, Mgr. • **Woodbridge, N. J.**, Ray D. Flatland, Mgr. • **Portland, Ore.** • **Seattle, Wash.** • **In Canada:** Industrial X-Ray Engineers Ltd., Andy Jordheim, Mgr., Edmonton, Alberta • **In Venezuela:** Industrial X-Ray of Venezuela, Ltd., Thomas Urell, Mgr., Maracaibo, Venezuela

Industrial X-Ray Engineers have the answer to your weld control problems!

Industrial X-Ray Engineers are specifically dedicated to solving your weld control and weld inspection problems with no loss in production time! With the opening of our new strategically located offices in Houston, Denver, Chicago, Los Angeles, and Woodbridge, N. J., you can command, at a moment's notice, the largest, most experienced weld examination organization in the world. Wherever welds are used, you need the protection offered by an organization with 13 years experience successfully examining welds on pipelines, refineries, penstocks and marine vessels. The only way to know what's there is to see it . . . and we can show it to you!

CONTRACTORS OF WELD EXAMINATION
X-RAY — GAMMA RAY — MAGNETIC — PENETRANT DYES

Industrial X-RAY Engineers

MAIN OFFICE: 115 BELMONT AVE. N.
SEATTLE, WASHINGTON

H. C. Sawyer

L. E. Wallace

Orbit Valve Company Appoints Two Regional Sales Managers

H. C. (Buz) Sawyer and L. E. (Ed) Wallace have been appointed as regional sales managers of Orbit Valve Company at Midland, Texas, and Tulsa.

Sawyer, who has been Mid-Continent district manager in Tulsa since October, 1949, will move to Midland where he will supervise a division consisting of North Texas, West Texas, New Mexico and an area extending into the Rocky Mountains. Sawyer joined Orbit Valve Company in 1945.

Wallace joined the firm in 1946 as field representative with headquarters at Newark, Ohio. He will supervise an area consisting of the Gulf Coast, Southwest Texas, East Texas, Louisiana and Mississippi.

John F. Arthur Appointed Manager of Truck Tire Sales

John F. Arthur, formerly district manager of the San Francisco branch of United States Rubber Company, has been appointed manager of United States truck tire sales with headquarters in New York.

Richard M. Payson, formerly manager of farm market sales, will succeed Arthur in San Francisco. Another appointment made by the company was the promotion of John W. Carpenter, district manager of the Fisk-Gillette division in New York, to district manager of the Denver branch.

Tuboscope Company Announces Reorganization and Officers

New officers of Tuboscope Company have been announced following a recent reorganization of the company. J. W. Bozeman is president and other officers are B. H. Pickard and Harry Bozeman, vice presidents, and H. E. Berry, secretary-treasurer.

J. W. Bozeman

Bozeman announced that Tuboscope will continue to provide specialized tubular inspection services above and below surface and will continue its research in the development of better inspection methods.

Industrial Tape Corporation Opens New Warehouse Facilities

New warehouse facilities are to be opened in March in Dallas, Texas, by Industrial Tape Corporation of New Brunswick, N. J., to serve the growing sales markets in Texas and surrounding areas.

William Cooker will supervise operation of the warehouse and will handle distribution of Industrial Tape Corporation's line of Permacel and Texcel tapes. The new warehouse brings the total number maintained by the company to eight.

Downing Is Representative For Cardwell Manufacturing

The Cardwell Manufacturing Company, Inc., Wichita, Kan., has announced the appointment of L. L. (Len) Downing as the firm's new Rocky Mountain sales representative. Downing was Kansas representative for Baash-Ross Tool Company prior to joining Cardwell.

Cost Accountants Tour Plants

One hundred members of the Houston Chapter of the National Association of Cost Accountants visited the A. O. Smith Corporation's Houston LPG vessel manufacturing plants and the A. O. Smith Corporation of Texas' pipe mill on March 20.

Foxboro's Montreal Plant Grows

A new plant extension by The Foxboro Company, Ltd., at Montreal has more than doubled its instrument manufacturing facilities in Canada. The new section of the factory adds 23,000 square feet of space for production, assembly of instrument panels and cabinets, storage of materials, and for enlargement of the plating, finishing and shipping departments.

Hercules Opens New Shop

Hercules Oilfield Division of Hercules Motors Corporation has opened new sales and service facilities in Oklahoma City. The new shop will stock Hercules engines and power units for immediate delivery, and will provide services to repair, overhaul and rebuild such units.

YOUR U.S.A.

Freedom is not one single thing; it is many: freedom of speech, of worship, of the press; freedom to vote, to work at what we please, to quit our job, to run a business of our own; to compete fairly and freely in the market place; to make our own decisions in conformity with Christian ethics and the rights of our fellow men. Freedom is social and economic Liberty.

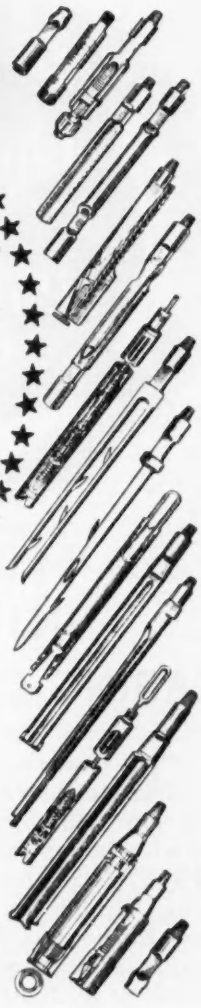
Let us be quick to detect those who would persuade us to exchange a single basic freedom for a socialistic gold brick disguised as some kind of dubious security. To surrender one Freedom is to risk losing them all.

SPANG PROSSER-TYPE SWIVEL ROPE SOCKET

The Prosser-Type Swivel Rope Socket is typical of the many ruggedly efficient Spang Cable Tools that are known and preferred throughout the world.

Made of a grade and type of steel particularly suited to this product, it is first semi-finished and bored. It is then heat-treated to give it a uniform toughness and the proper hardness both inside and out. Finally, it is finish turned, the tool joint threaded and the side holes drilled.

The result—a swivel rope socket of superior quality, delivering maximum service for safe, efficient drilling.



PETROLEUM EQUIPMENT SUPPLIERS' ASSOCIATION

The HIGHER STANDARD

SPANG CABLE TOOLS made by SPANG & CO., BUTLER, PA.

for OIL WELLS • GAS WELLS • ARTESIAN WELLS SHOT BLAST HOLES • PROSPECT DRILLING

SPECIFY SPANG—FOR SALE BY DEALERS EVERYWHERE

The Western Company Advances C. E. Smith, Charles Simmons

C. E. Smith and Charles Simmons were promoted recently by The Western Company when they were named sales representative in the Lubbock, Texas, area and pumping services manager of the Panhandle-Western Kansas district, respectively.

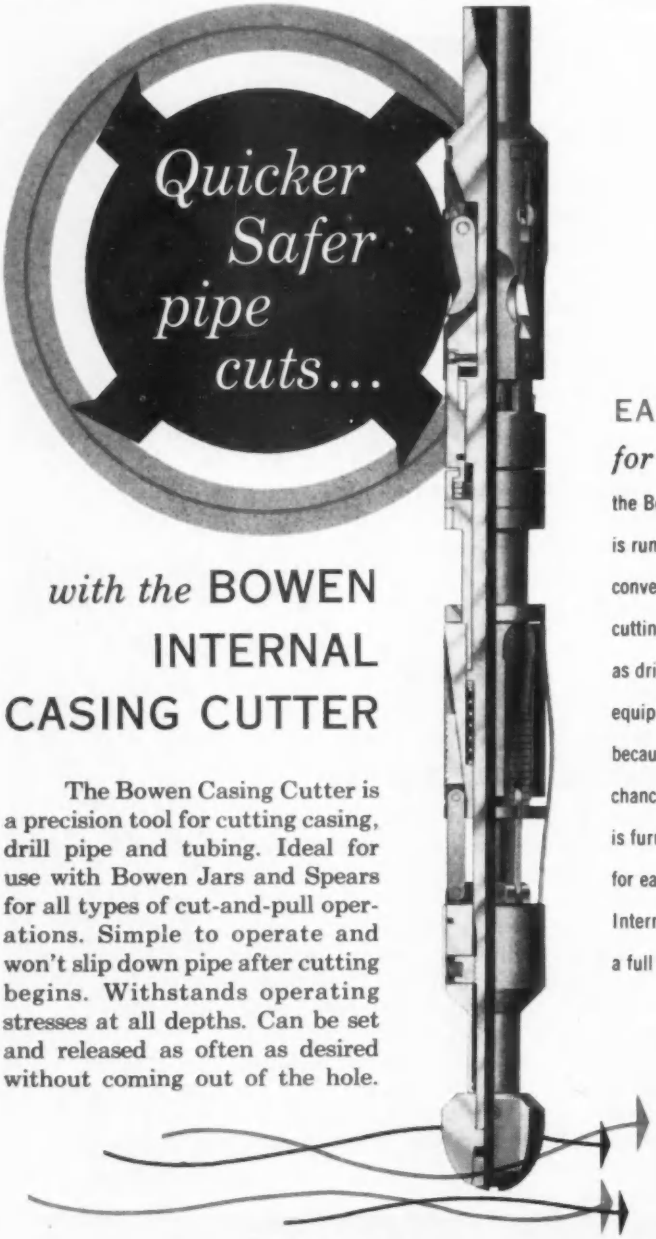
Smith has been with Western since 1944 and formerly was manager of Western's Panhandle-Western Kansas district. Simmons has been with the company for five years and has served as district engineer, station manager and assistant district manager in the Permian Basin districts. He will make his headquarters in Borger, Texas.

Honeywell Valve Division Names Three to Field Posts

Frank Day, Vincent Lo Scalzo and V. L. Evans have been assigned to field sales posts for the Valve division of Minneapolis-Honeywell Regulator Company. Day will handle industrial valve sales in the New Orleans area, Lo Scalzo in Kansas City, and Evans in Wilmington, Del.

Represents Penflex in Louisiana

The Pennsylvania Flexible Metallic Tubing Company has appointed Murray-Baker-Frederic, Inc., New Orleans, as its distributor in that territory. The New Orleans company will handle the complete Penflex line.



with the BOWEN INTERNAL CASING CUTTER

The Bowen Casing Cutter is a precision tool for cutting casing, drill pipe and tubing. Ideal for use with Bowen Jars and Spears for all types of cut-and-pull operations. Simple to operate and won't slip down pipe after cutting begins. Withstands operating stresses at all depths. Can be set and released as often as desired without coming out of the hole.

EASY TO RUN *for cutting casing,* the Bowen internal cutter alone is run in and operated in the conventional manner. But for cutting the smaller diameters, such as drill pipe and tubing, accessory equipment is recommended because it practically eliminates chance of errors. This information is furnished operators by Bowen for each individual job. Bowen Internal Cutters are available in a full range of sizes.

Write for a free copy of Bowen's operation and instruction manual which tells of the greater service and satisfaction to be obtained from BOWEN CASING CUTTERS.

SR BOWEN CO

MAIN OFFICE AND PLANT:
11008 SOUTH NORWALK BOULEVARD
SANTA FE SPRINGS, CALIFORNIA
EXPORT OFFICE:
30 ROCKEFELLER PLAZA
NEW YORK CITY, NEW YORK
EXPORT REPRESENTATIVE: VAL R. WITTICH JR.

Henderson Receives Promotion From Dowell Incorporated

Dowell Incorporated has announced the promotion of J. K. Henderson, district engineer at Wichita Falls, Texas, to chief field engineer in Tulsa, Okla.

J. K. Henderson

A graduate of the University of Oklahoma, Henderson joined the Dowell organization in 1947 in Shreveport, La., as a service engineer, later becoming area development engineer. In his new position Henderson will serve as liaison between the various laboratories, technical development group and the engineers in the field.

American Locomotive Names New Regional Sales Heads

Appointments to new sales, administrative and manufacturing posts have been announced by American Locomotive Company following reorganization of the company's administrative personnel.

In the Alco Products Division, A. T. Lawrance was named regional manager of sales offices located in Houston, Tulsa, Los Angeles, and also Beaumont, Texas. He is, in addition, plant manager of the Beaumont Iron Works. In the same division, Paul W. Geisler was named regional manager of sales in New York, Dunkirk, N. Y., and Chicago.

Walter E. Beline was named manager of the New York district, and L. W. Eger was appointed manager, sales-service, at Dunkirk.

Republic National Bank, Dallas, Elects R. L. Tayloe Director

Republic National Bank of Dallas recently named a new director and two vice presidents. J. W. Denny and John W. Stovall were advanced from assistants to vice presidents at the annual stockholders meeting, while R. L. Tayloe, vice president in charge of Sears, Roebuck and Company's Southwestern territory, was elected a member of the board of directors.

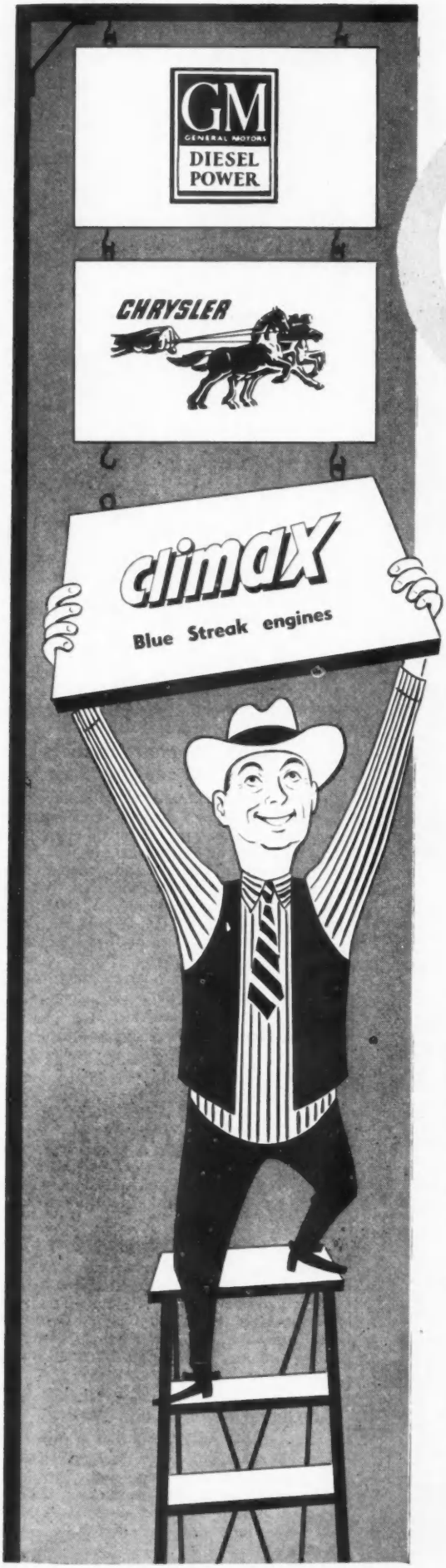
Tayloe has been associated with Sears since 1939 and in his present capacity is responsible for the sales territory of Texas, Oklahoma, New Mexico and parts of Louisiana and Arkansas.

Hasenzahl Is Named Manager Of Trailmobile Manufacturing

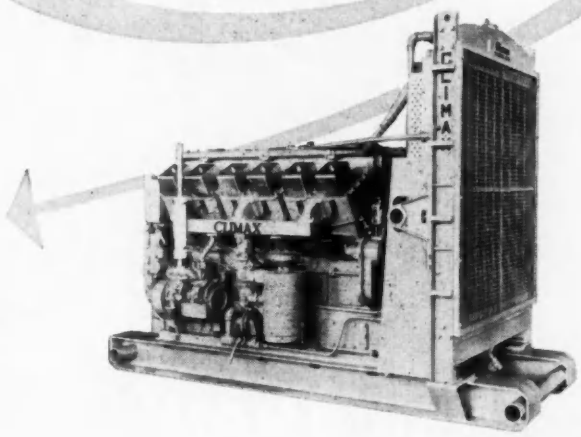
Trailmobile Inc. has appointed Walter Hasenzahl, Jr., of Fort Thomas, Ky., as general manager of manufacturing. He formerly was plant industrial engineer at Cincinnati and in charge of Trailmobile's plant re-layout program there. Prior to joining Trailmobile, Hasenzahl was employed by Master Electric Company, Dayton, Ohio, Noma Electric Corporation, Hamilton, Ohio, and Toledo Desk & Fixture Company.

Names Philadelphia Distributor

U. S. Steel Corporation's National Tube Division has appointed Morris, Wheeler & Co., Philadelphia iron and steel dealers, as distributors for seamless pressure tubing in iron pipe sizes.



Something NEW Has Been Added!



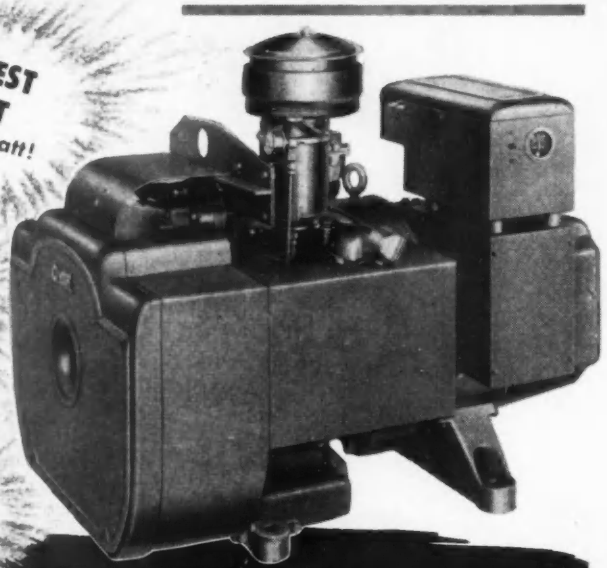
Stewart & Stevenson Services has been named Texas Distributor for *Climax* Blue Streak engines

Addition of this new line of engines completes the range of power requirements for Texas industries now supplied by Stewart & Stevenson. And Climax Blue Streak Engines will be backed by the same sales and service facilities and the same guarantee that have helped Stewart & Stevenson to become the nation's largest distributors of General Motors Diesel Engines. Climax engines will make available to natural gas or butane users throughout Texas a complete range of fine engines up to 600 horsepower. The engines will be sold and serviced by all Stewart & Stevenson branches. Your Stewart & Stevenson representative will be glad to give you complete details on how Climax Blue Streak Engines will fill your power requirements.

STEWART & STEVENSON SERVICES, Inc.

Main Office and Plant: 4516 Harrisburg Blvd., Houston 11, Texas. Phone WO odcrest 9691.
Branches: Corpus Christi,, Dallas, Lubbock, Wichita Falls, McAllen (San Juan), Odessa.
Representatives: San Antonio, Longview, Brownsville, Beaumont, Laredo, Port Arthur.
Distributors of: General Motors Diesel Engines, Climax Blue Streak Engines, Chrysler Industrial and Marine Engines, Chicago Pneumatic Engines, Petter Diesel Engines, Gardner-Denver Pumps.
Fabricators of: Engine Driven Electric Generator Sets, Portable Pumping Units, Truck Bodies, Oil Field Equipment.

Take a good look at this New Powerhouse!



The ONAN "CW" Electric Plant

5,000 or 10,000 WATTS

Designed to fit every application better . . . standby, portable, mobile and stationary. *Whatever* your need for electric power, the new Onan CW-5 and 10 give you top performance and value!

Here for the first time are 5 and 10KW electric plants powered by revolutionary, new air-cooled gasoline engines, *designed and built by Onan exclusively for electric plant use!*

Both engines are 1800 R.P.M. The 13HP Onan engine which powers the CW-5 and the 20HP Onan engine used for the CW-10 weigh much less than general-purpose engines, and are amazingly compact. Built to deliver dependable, trouble-free service in heavy-duty use. Two-cylinder, alternate-firing design assures smooth, vibration-free power. New, quiet, highly-efficient vacuum air cooling drives out all heated air through *one* side duct. The same duct carries exhaust gases, simplifying installation.

Impulse-coupled, high-tension magneto ignition for quick starting under all conditions. Both models in all standard voltages 60-cycle A.C., single or three phase.

Far-Out-Front in design and engineering

● Twin-cylinder, horizontally-opposed, air-cooled, alternate-firing engines ● Aluminum-alloy cylinder heads ● Extra-large, replaceable bearings ● Full-pressure lubrication, 6-quart oil capacity, oil filter ● Impulse-coupled, high-tension magneto ignition, radio suppressed ● Quiet, vacuum air-cooling of generator and engine ● Excellent accessibility; snap-off air housings ● High-performance generators ● Completely equipped with controls and instruments.

Write for folder and specifications

Onan ELECTRIC PLANTS

D. W. ONAN & SONS INC.

5976 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINNESOTA

Ralph F. Griffin

Robert L. Ledeker

Alten Foundry & Machine Works Names Sales Representatives

C. W. Freeman

Three new sales representatives announced by Alten Foundry & Machine Works, Inc., Lancaster, Ohio, are Robert L. Ledeker, Ralph F. Griffin and C. W. (Clem) Freeman.

Ledeker will represent Alten in Kansas and has set up an office at Hutchinson. Griffin has been assigned to the tri-state territory including Indiana, Illinois and western Kentucky. His temporary offices are in Princeton, Ind. Freeman represents Alten in Oklahoma with headquarters at Duncan.

Bailey Meter Company Advances Wallace to Cleveland Sales Post

G. M. Wallace, manager of Bailey Meter Company's Denver district, has been appointed an assistant sales manager with headquarters in Cleveland. He will supervise the sale of meters and control equipment to the process industries. Wallace started with the company in 1940, and became manager of the Denver district in 1945. He is a graduate of Rensselaer Polytechnic Institute, Troy, N. Y., and a member of the American Society of Mechanical Engineers.

Welex Names New Sales Manager

Welex Jet Services, Inc., Fort Worth, recently named J. B. Vaughan, general sales manager, replacing A. M. Birnie. Vaughan comes to Welex from the Great Lakes Corporation, where he was assistant general sales manager. He also has been associated over a period of years with Halliburton Oil Well Cementing Company and Fred M. Manning, Incorporated.

Headquarters Moved to Calgary

Maloney-Crawford of Canada, Ltd., has moved its offices from Edmonton to Calgary, Canada. George H. Cheatam is vice president of the Canadian subsidiary. In addition, the Canadian firm has opened sales and service representation at Birden, Manitoba.

Alexander Rejoins Lane-Wells

James F. Alexander has returned to Lane-Wells Company after completing a 16-month tour of duty with the Army. Formerly Los Angeles district superintendent he is now assigned as assistant to the Mid-Continent division operating superintendent.

Broom Transferred to Utah For McCullough Tool Company

J. Sidney (Sid) Broom has been appointed fishing tool service engineer at the McCullough Tool Company's Vernal, Utah, branch.

J. Sidney Broom

Broom has had more than 26 years of experience as a driller, toolpusher, and superintendent with oil companies and drilling contractors in the Rocky Mountain, Mid-Continent, and California oil fields. During the past year he has been working out of the McCullough Los Angeles headquarters as a fishing tool service engineer.

Ansul Chemical Company Opens Three New Branch Offices

Ansul Chemical Company of Marinette, Wis., manufacturers of dry chemical fire extinguishing equipment, has opened new branch offices in the Houston, Dallas-Fort Worth and Tulsa areas.

District sales will be supervised by C. H. Armstrong. Virgil Murry will manage the Dallas-Fort Worth office in Fort Worth, and Roger Allen will manage the Tulsa office. Warehouses will be maintained in Houston and Kansas City, handling the company's line of industrial chemicals as well as fire equipment.

International Glass Purchases Perrault Glass Fiber Works

International Glass Corporation has purchased all plant facilities and equipment of Perrault Glass Fiber Corporation in Newport, Ark., which has been one of the world's two largest manufacturers of pipe wrap for the oil industry. The new acquisition plus the company's two other plants in Puente and South Gate, Calif., places International Glass Corporation among leading glass fiber and optical manufacturers. Executive offices and research laboratories are in Los Angeles.

Full production at the Arkansas plant will be resumed soon after present engineering improvements are completed. The plant produces glass fiber and glass fiber pipe wrap outer wrapping for pipe, roofing material, battery retainers, battery separators and irrigation canal liner.

Baroid Names New Sales Manager

Kemp S. Lewis has been appointed manager of Mineral and Chemical Sales by Baroid Sales Division of National Lead Company. Lewis who joined Baroid as a service engineer in 1939, is a graduate of Rice Institute. He served as district superintendent in the Well Logging department in 1941 just prior to being called to military service for four years. He has served as division superintendent of the department since 1949.

Prefex Plastics Expands Plant

Prefex Plastics, Inc., Chicago manufacturers of injection and extrusion custom molders and Butyrate plastic pipe and tubing, has moved its production facilities and administration offices to a new Chicago plant on South Dearborn Street.

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ALTEN
PUMPING UNITS
for . . .
BEST HELICAL GEARS
COMPLETE PRETESTING
HARDEST GEAR SURFACES
You can avoid shutdowns before they occur and roll up more income producing hours if you pump with Alten units. Each is thoroughly pre-tested before being shipped to the field. And that's only part of the story. Specially hardened Alten helical gears are the best ever developed for pumping purposes. Get enduring service at full rated capacity—buy Alten at your supply store.
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SALES OFFICES
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Olney, Illinois
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Duncan, Okla.
Abilene, Texas
Houston, Texas
Casper, Wyoming
Edmonton, Alberta, Canada
EXPORT OFFICE
New York City
WAREHOUSES
Lancaster, Ohio
Wichita Falls, Texas
Houston, Texas
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STOPS WEEDS

Wherever ground must be kept bare of fire-hazardous weeds and grasses... use BORASCU... the modern, low-cost weed killer! Ease of application and effective results make BORASCU a very wise choice for the long-lasting destruction of unwanted vegetation about your tank batteries, well sites and heater units, etc. Weeds *can't* grow on ground that has been properly treated with BORASCU. Nor do you need special equipment... just a man, a pail, and BORASCU.

CONCENTRATED BORASCU WEED KILLER ®

- NOTHING TO MIX
- NO WATER TO HAUL
- NONCORROSIVE TO FERROUS METALS
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Kills weeds for pennies

Saves you Dollars

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

Sales Offices

Weed Control Representatives located in: AMARILLO, FT. WORTH and HOUSTON, TEX. • AUBURN, ALA. • NEW YORK CITY • PHILADELPHIA • CHICAGO • CLEVELAND • DENVER KANSAS CITY, MO. • MINNEAPOLIS, MINN. • POCATELLO, IDAHO • PORTLAND, ORE. SAN FRANCISCO. Home Office: 630 SHATTO PLACE, LOS ANGELES 5, CALIFORNIA

R. C. Davis

D. M. Cowart

Canadian Division Offices Opened by Schlumberger

Establishment of two division offices of Schlumberger Well Surveying Corporation in Canada under the supervision of Calgary headquarters has been announced.

R. C. Davis, formerly district manager at Edmonton, Alberta, Canada, will head the new Western Division office. An employe of Schlumberger since 1937, Davis served in the Texas and Mid-Continent areas before going to Canada. D. M. Cowart, formerly at Shreveport, La., will be manager of the Eastern Division with offices at Regina, Saskatchewan.

Security Engineering Names Scott Regional Sales Manager

Cecil C. Scott has been appointed central mid-continent regional sales manager for Security Engineering Company. Scott will have charge of sales in Texas west of Abilene, as well as in New Mexico, Colorado, Wyoming and North Dakota territories.

Starting with Security in Odessa, Texas, in 1946 as a sales engineer, Scott was transferred to Kermit, Texas, and later to Hobbs, N. M. In 1950 he became divisional manager at Odessa for the West Texas-New Mexico area.

Industrial, Marine Engine Division Formed by Reo Motors

Activation of the Industrial and Marine Engine Division of Reo Motors, Inc., Lansing, Mich., has been announced. The new division sales and engineering activities will be headed by R. D. Jacobs, II, who was formerly a marine installation engineer serving as advisor for sales for General Motors Diesel Engine Division in Detroit before joining Reo.

Stewart and Stevenson To Handle Climax Engines

Stewart and Stevenson Services has been appointed Texas distributor for Climax Blue Streak engines. The addition of the new line of engines completes the range of power requirements demanded by Texas industries in diesel, gas, gasoline and butane. Climax Blue Streak Engines will be sold and serviced by Stewart and Stevenson branches throughout Texas.

Williams Appointed Manager Of Baash-Ross Manufacturing

W. J. (Bill) Williams has been appointed works manager for Baash-Ross Tool Company and will coordinate production and manufacturing operations throughout the 17 major plants and service shops. Williams has specialized in design, development and manufacturing of oilfield products for the past 26 years. He recently completed organization of production operations for the new Baash-Ross Odessa plant.

Drilling in Trinidad

Dense tropical foliage surrounds this National Supply Company Ideal type 130 rig engaged in deep exploratory drilling for Apex (Trinidad) Oilfields, Ltd. Other companies operating Ideal type rigs are Trinidad Leaseholds, Ltd., and Trinidad Petroleum Development Company, both use type 125 rigs in Trinidad operations.

Emsco Announces Name Change

Emsco Derrick & Equipment Company has changed its name to Emsco Manufacturing Company. The change was effective January 1. Emsco has plants in Los Angeles and at Garland and Houston, Texas.

Penflex Names New York Manager

Richard T. Patriquin has been appointed New York sales manager for Pennsylvania Flexible Metallic Tubing Company. He has had several years experience with Penflex and most recently was field representative for William Townsend, vice president. He joined the company as a salesman in the Philadelphia territory.

Oilwell Division Names Fister Director of Employe Relations

O. J. Fister has been named director of employe relations for the Oil Well Supply Division of United States Steel Corporation. Fister has been with U. S. Steel for more than 17 years, having joined Federal Shipbuilding and Dry Dock Company, a former subsidiary, in 1935.

Aeroquip Negotiates License Of Birmingham, England, Firm

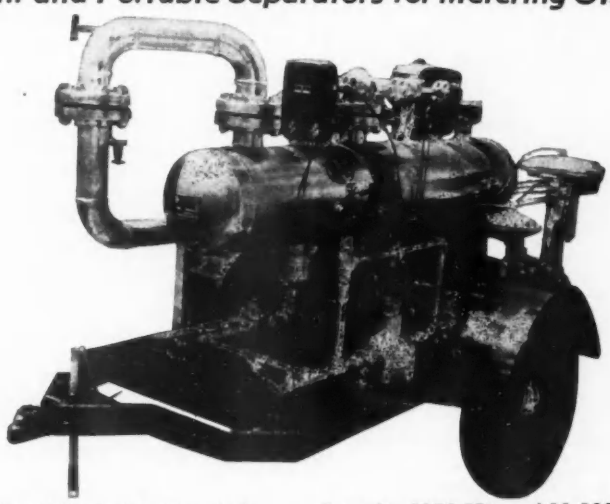
Aeroquip Corporation has successfully concluded a licensing arrangement with Super Oil Seals & Gaskets, Birmingham, England. The license permits British manufacture and sale of Aeroquip products in Great Britain, Australia, New Zealand and South Africa. This license applies to all aircraft, military and commercial applications of Aeroquip products.

Jacoby Receives Promotion

John W. Jacoby has been appointed manager of pump fluid end parts sales for U. S. Steel's Oil Well Supply Division. Jacoby joined "Oilwell" in 1943 as a design engineer and became assistant to the chief engineer in 1948. Later he became assistant to director of engineering at headquarters in Dallas, where he supervised field research and development work.

ROLO WELLCHECKERS

Permanent and Portable Separators for Metering Oil and Gas



Rolo No. 12 H-1607 Trailer Mounted. **Capacity 2000 BPD and 11,500 MCF gas.**

Rolo Wellchecker No. 12 H-1607 has vessel 16" x 7 ' x 1200# w.p. code labeled, with 4" gas run, manual by-pass, automatic water knockout, special sample cocks and thermometer wells. Oil, gas and water are removed in separate lines, metered, and then recombined, if desired.

Made in all sizes to fit any operation, Rolo Wellcheckers are shipped with all controls, piping and accessories ready to operate. Rolo Wellcheckers enable the operator to check production daily and to secure accurate records for royalties and taxes. See Composite Catalog or write for illustrated bulletin.

Oil Well Metering Specialists

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BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles, Bakersfield, Casper, Calgary, (Alta)
Petroleum Industry Consultants, Apartado 3992, Caracas, Venezuela
EXPORT OFFICES: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N.Y.

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...plug bit for our diamond core head

. . . regardless of what your drilling or coring problems are . . . contact us or we both lose money.

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ODESSA • SAN ANGELO
ABILENE • VICTORIA

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Diamond Bit & Coring Service Co.
Kingston, Oklahoma

INVENTED, DESIGNED & MFG'D BY
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RATES: Regular Classified (undisplayed) set in this size type: 12 cents per word. Minimum charge, $3. Blind box address in our care counts six words. Replies forwarded without charge. **Situation wanted** ads, 6 cents per word. **Display ads,** set in suitably larger type with ruled border, $12 per column inch; situation wanted display ads, $6 per column inch. Ten percent discount for two or more insertions of same copy in consecutive issues. **All classified ads payable in advance. COPY DEADLINE:** 5th of month preceding date of issue. Send copy and checks to: **Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.**

FOR SALE

FOR SALE

Unretouched Photograph

FOR SALE

Seismograph Service Corp. 24 channel instrument truck, completely overhauled, all instruments put in like-new condition. 26 amplifiers, 28 galvanometers, 30 geophones (Midwestern Type 200), 2 new 1400′ cables. Instrument cab completely new, all steel construction, stainless steel lined with 1/16" stainless steel floor welded over 3/16" steel sub-floor. F6 Ford truck, aprox. 5,000 miles, completely repainted, equipped with heavy-duty front bumper and brush guard, fender clearance increased and heavy-duty raised running boards installed, has turning lights and Leech-Neville generator for battery charging.

Priced Exceptionally Low . . . For Immediate Sale

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TULSA • PHONE 7-7521

MIDWESTERN GEOPHYSICAL LABORATORY

■ **TWO 150 horsepower F and T boilers located at Eunice, New Mexico, Makin Drilling Co., Box 131, Hobbs, New Mexico.**

■ Model P oil well mud pump 6 x 12, A1 condition. Can be inspected. Ideal for light rotary or reverse circulator. $4500.00. Davon Drilling Company, Oklahoma City, Oklahoma.

■ At Oklahoma City, Oklahoma. N-7 Brewster, owned by an oil company, has drilled very few holes, equipped with 3 NKU Waukesha, D-500 Emsco Pump, 127 foot Lee C. Moore derrick, 7 foot sub-structure, very complete in every detail. Presently running, will stand rigid inspection. Will sell with or without drill pipe. Box 77-W, c/o World Oil, Houston, Texas.

Inter-Communication Equipment
(Dictograph Products, Inc.)

Manufacturers Type Boxes
1—E-20-E Executive Station—Automatic and/or Handset
4—20 Station Boxes—With Handset
6—12 Station Boxes—With Handset
11—Junction Boxes complete with connecting cords.

New Cable (5 years)
289 Ft. No. 102 Cable (51 pair)
100 Ft. No. 82 Cable (41 pair)
625 Ft. No. 66 Cable (33 pair)

Converted Manufacturers Type Boxes with Handsets
19—14 Station Boxes
1—12 Station Box
2—10 Station Boxes
22—Junction Boxes complete with connecting cords.

Box 79-W, c/o World Oil, Houston, Texas.

■ New modern 8 lane prosperous Bowling Alley. Doing big business every day. Rare opportunity to get in big paying business at a bargain. If interested and have money, come and see. Fifty miles south of Houston, Texas. Brazosport Bowling, 20th St. Velasco Heights, P. O. Box 191, Phone 9635, Velasco, Texas.

SITUATIONS WANTED

■ RADIO ENGINEER. Graduate with FCC operator's license and five years experience in V.H.F.—microwave communications field including site surveys, FCC licensing, system design and field installations, desires position with pipe line company having or contemplating a microwave system. Box 78-W, c/o World Oil, Houston, Texas.

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

HELP WANTED

■ Division Geologist with Louisiana Gulf Coast region subsurface experience required by sound, substantial company in New Orleans. In reply, please state salary expected and give details of education and experience. Replies confidential. Box 75-W, c/o WORLD OIL, Houston, Texas.

BUSINESS OPPORTUNITIES

WILLISTON BASIN ROYALTIES

Dealers in Montana royalties since 1921, we now specialize in royalties under major company leases in the Montana portion of the Williston Basin. For information on our method of operation, write LANDOWNERS ROYALTIES COMPANY, Box 1225, Great Falls, Montana.

■ Hamilton & Hamilton, Inc. and Associated Companies, Northern Petroleum Company and Petroleum Acreage, Inc., have producing and semi-proven oil and gas leases in Montana, to sell or sub-lease to reliable parties on working agreement basis. Write for information: P. O. Box 1605, Room 535 Ford Bldg., Great Falls, Montana.

DECALS

TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

MISCELLANEOUS

WANTED—OLD COPIES OF THE COMPOSITE CATALOG

If you have any copies of the 1929, 1930, 1931 or 1932 editions of The Composite Catalog that you do not need we can put them to good usage. Please advise The Librarian, Gulf Publishing Company, P. O. Box 2608, Houston, Texas.

PRINTED FORMS FROM STOCK

Immediate delivery of producing and pipe line forms made from our complete line . . . Write for completely illustrated catalog.

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P. O. Box 2608 Houston 1, Texas

Edward Valves Adds Building To House Engineering Work

Edward Valves, Inc., has built a modernistic two story structure of stainless steel and glass at East Chicago, Ind., to house its Engineering department. The entire north wall is composed of plate glass windows allowing maximum use of natural north light for drafting purposes. The building is adjacent to Edward's Research Laboratories.

Cleco Names Four Suppliers

Cleco Division of Reed Roller Bit Company, Houston, has appointed H. B. Bighouse Company, Newark; Nixon Machinery Company, Nashville, Tenn.; Swing Machinery and Equipment Company, San Antonio; and San Antonio Machine & Supply Company, Waco, Texas, as distributors for Cleco products.

A. O. Smith Announces Expansion

A. O. Smith Corporation, Milwaukee, has begun construction of a new, modern electrode plant at Lancaster, Penn. The single-story plant will contain 41,000 square feet of floor space and is scheduled to be completed by late July.

U. S. Rubber Promotes Scoville

United States Rubber Company has appointed Warren E. Scoville, Jr., assistant manager of the development department's Passaic, N. J., plant. Scoville has been employed in the development department since graduating from Stevens Institute in 1934.

New Books, Maps and Movies

FUNDAMENTAL RESEARCH ON OCCURRENCE AND RECOVERY OF PETROLEUM, Lloyd E. Elkins, chairman, Advisory Committee on Fundamental Research, American Petroleum Institute, 50 West 50th Street, New York 20. $6 (Non members API); $3.60 (Members API and contributors).

This volume covers a compilation of data of six different investigations. These investigations, known as research projects 37, 43, 47 and 51, are reported for the period 1950-51. Twenty two papers detailing results of several projects, are included.

THE ECONOMICS OF NATURAL GAS IN TEXAS, Bureau of Business Research, The University of Texas, Austin. $5.

The essence of the monograph published by the University of Texas is: Texas is still the best customer for its own natural gas production and despite many unsolved technical and policy problems, the natural gas industry provides a stable foundation for future expansion of the Texas economy.

The report was written by Dr. John R. Stockton, bureau director, Richard C. Henshaw, Jr., and Richard W. Graves.

SUMMARY OF OPERATIONS IN CALIFORNIA OIL FIELDS, Annual Report of State Oil and Gas Supervisor, Department of Natural Resources, Division of Oil and Gas, Ferry Building, San Francisco.

Special articles dealing with various phases of oil field operations appear in this annual report from California. Oil and gas fields are shown on numerous maps included in the publication and are easily located by use of indexed lists. Information on each field includes description, history, geology, drilling and completion practice, and production.

ALASKAN INDEX MAP, Geological Survey, Department of the Interior, Washington 25, D. C. Free.

A new index map of Alaska, this publication shows discovery and development of mineral resources in that Territory. It was compiled by E. H. Cobb, geologist, as an index to reports published by the Geological Survey. The map is compiled at a scale of approximately 60 miles to the inch and a finding list showing commodities and areas listed appears on the same sheet with the map.

MALEIC ANHYDRIDE DERIVATIVES, Lawrence H. Flett and William Howlett Gardner, John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. $6.50.

Most of the reactions of maleic anhydride described in the volume illustrate the chemistry of the double bond, basic to the synthesis of almost all industrial organic chemicals. For this reason, research workers and industrial chemists in many fields, including petroleum, will find the volume particularly suited to their needs.

Each preparation is conveniently arranged across two facing pages. The right-hand page includes the net equation and a description of the method; comments, a description of the reaction products, and possible uses are given on the left-hand page.

EXAMINATION OF WELL CUTTINGS, Quarterly of the Colorado School of Mines, Volume 46, Number 4, Julian W. Low, Golden, Colorado. $1.50.

The author states that the purpose of this manual is to make available to the beginning microscopist the methods that have been proved successful in the course of many years of application in oil geology. The manual attempts to present only one phase of subsurface work—lithologic determination of well samples by means of the low-power binocular microscope, the present "work horse" of the oil companies.

GEOLOGY AND OIL POSSIBILITIES OF THE PHILIPPINES, Dr. Grant W. Corby, et al., director Bureau of Mines, Philippine Department of Agriculture and Natural Resources, Republic of the Philippines, Manila. $5.50.

This official publication consists of a report by Dr. Grant W. Corby of the results of the geological survey of the Philippines conducted by the Philippine Government shortly before the war. It is published as Technical Bulletin No. 21. A pocket in the binding contains 41 loose-leaf plates, mostly maps in black and white.

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Scientifically Formulated to Combat the Elements!

ROUGHNECK Synthetic Enamel is formulated to meet the needs of the oil industry . . . with durability as first consideration. Applied by brush or spray . . . with or without a primer . . . heavy duty contents of ROUGHNECK withstand weather, rough handling and corrosion.

ROUGHNECK is available in color selections for every company requirement. Write **today** for a complete color card.

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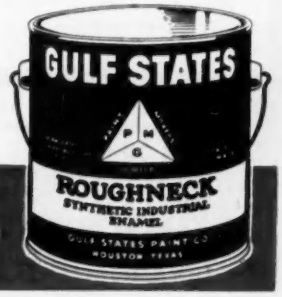
A Product of



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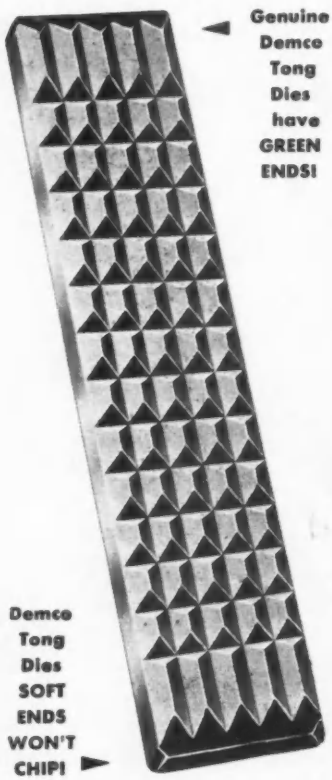
DRILLING EQUIPMENT MFG. CO.
DEMCO
OKLAHOMA CITY, OKLA. U.S.A.

"NO-CHIP"
TONG
DIES



Genuine Demco Tong Dies have GREEN ENDS!

Demco Tong Dies SOFT ENDS WON'T CHIP!

Also available in standard tooth

FOR SAFETY'S SAKE always get the original Demco "No Chip" soft end tong dies! They help reduce accidents on the derrick floor. And even on flame hardened surfaces Demco Tong Dies give you maximum gripping power! They're reversible, for longer wear and easy installation!

Sold thru Supply Stores

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SQUEAKS from the BULLWHEEL

Yale versus Harvard

A Boston brokerage advertised for "a young Harvard graduate or the equivalent."

Among the answers was one from a Yale man. "When you speak of equivalent," he wrote, "do you mean two Princeton men or a Yale man half time?"

•

Sermon to Remember

A wealthy farmer decided to go to church on Sunday. After the services he approached the preacher with much enthusiasm.

"Reverend, that was a damn good sermon you gave, damned good."

"I'm satisfied that you liked it, but why use such terms in expressing yourself?"

"I can't help it, Reverend, I still think it was a damned good sermon. As a matter of fact, I was so impressed, I put a hundred dollar bill in the collection plate."

"The hell you did."

•

Another Reason

Student: "Why didn't I make 100 percent on my test?"

Teacher: "You remember the question, 'Why did the pioneers go into the wilderness?'"

Student: "Yes."

Teacher: "Well, your answer, while very interesting, was incorrect."

"No use makin' eyes at me, Baby. This ain't my oil, I just work here!"

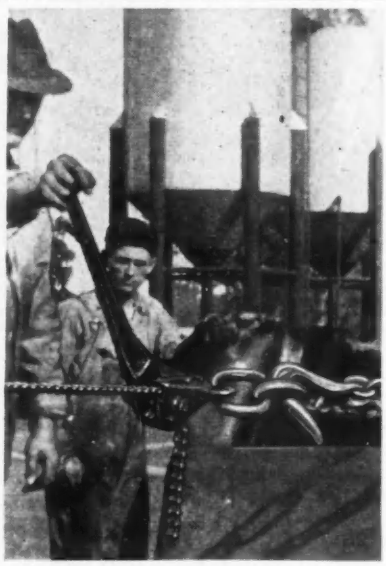
No Smoking or Bathing

The man had just bought a cigar in a department store and started to light it.

"Didn't you notice the sign?" asked the sales girl.

"What!" exploded the customer. "You sell cigars in here, but you prohibit smoking?"

The sales girl smiled sweetly: "We also sell bath towels."



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Here's why:

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Hooks will not break or straighten out.

Dual ratchet and pawl will not slip — even if handle is accidently released.

Handle will bend before any other part is overloaded beyond safe limits.

Every Safety-Pull is tested at 100 percent overload.

Write for Bulletin 04SP — and the name of your nearest distributor. Make use of his broad experience and complete service facilities.

Coffing Safety Pull Ratchet Lever Hoists. 10 roller chain models, ¾ to 15 tons. 2 coil chain models, ¾ and 1½ tons

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What's NEW

In Perforating, Logging, and Fishing Tool Services

McCULLOUGH
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

MORE OIL

McCullough Announces Improved Perforators Get Up To

25% MORE PENETRATION!

McCULLOUGH PERFORATOR	ONE STRING AND CEMENT TARGET	TWO STRINGS AND CEMENT TARGET	THREE STRINGS AND CEMENT TARGET	SOLID STEEL TARGET
**STANDARD CASING GLASS JET	7-1/8"	6-13/16"	6-1/8"	3-3/4"
3½" O.D. *M-3 BURRLESS BULLET	9-1/2"	6-11/16"	4-11/16"	1-7/16"
**SUPER CASING GLASS JET	8-1/2"	8-1/8"	7-5/16"	4-3/4"
4¼" O.D. *M-3 BURRLESS BULLET	10-3/4"	8-1/16"	6-1/16"	1-9/16"
**SUPER FORMATION GLASS JET	9-3/4"	9-3/16"	8-1/4"	5-3/4"
4¾" O.D. *M-3 BURRLESS BULLET	11-7/8"	9-1/16"	6-13/16"	1-5/8"

*McCULLOUGH M-3 BULLET PERFORATOR. An improved bullet perforator—the only perforator known that can outshoot the jet perforator in a single string target. Proved the hardest shooting perforator in the world under normal well and formation conditions—with burrfree holes to boot!

**McCULLOUGH GLASS JET PERFORATOR. Now in three sizes to meet every perforating problem. Hardest shooting perforator in the world when the going gets tough—in hard formations, two and three strings of casing, etc. Produces straighter sided holes and the only jet perforator that does not leave a slug of metal to plug the hole.

AVAILABILITY. Every McCullough branch has these improved McCullough Perforators. Call your McCullough Service Engineer today.

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FOR DETAILS

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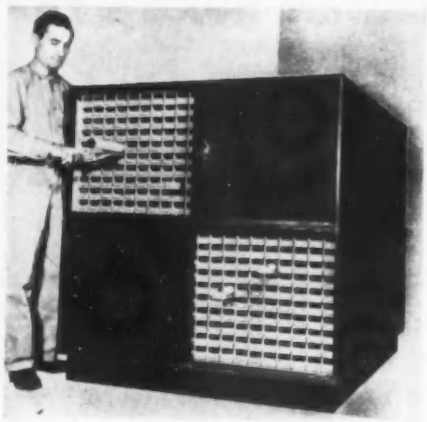
Seven Star Space Saver

The World's Best Horizontal-Sectional Map Cabinet!
25 years of map filing achievements!
No tubes or ragged lengths
No lost or wedged maps



The utility of the horizontal sectional type filing gives the definite advantage of large capacity within minimum floor space. Cabinet sections, when placed upon base, file 800 to 1000 maps in 16 square feet of floor space. No tubes to wedge maps or make them difficult to handle. The drawer-like slide eliminates injury to maps.

COMPARE THESE SEVEN ADVANTAGES

★ Convenient ★ Instant filing
★ Space-saver ★ Dust proof
★ Instant reference ★ Meddle proof
★ No tubes

No more ragged lengths; the 2 x 2 inch square compartments create a systematic and neat filing arrangement.

Exterior of cabinets are of ¾ inch five-ply, beautifully grained hardwood with mitered lock joints. Sliding doors are individually locked and keyed.

Cabinet finishes are available in Walnut, Oak, Mahogany, Olive Drab, Cabinet Grey, Natural or Blond wood.

DIMENSIONS

Height	Width	Length
13"	50¼"	47⅞" (44" map)
23½"	50¼"	47⅞" (44" map)
23½"	50¼"	59⅞" (56" map)

PRICES

Capacity	Price
100	$175.00
200	$265.00
200	$295.00

(Base $12.50 extra)

Index Label Holders $0.16 ea. Installed

Special Attention to Foreign Orders

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609 QUITMAN HOUSTON 9 TEXAS PHONE PR 0725

The Mourners

There was a sad accident one day in the heart of the Ozark Mountains. A farmer's mule kicked his mother-in-law to death. A tremendous crowd turned out for the funeral, but it was made up almost entirely of men. The minister commented, "This old lady must have been mighty popular because so many people will leave their work to come to her funeral."

"They're not here for the funeral," said the surprised farmer. "They're here to buy the mule."

•

Easy to Please

An actress thought she had an excellent plan for keeping her diamond necklace safe. She always left it on her dressing table with a note: "This is only an imitation. The real necklace is kept at the bank."

But one night she found it gone and in its place this note: "This necklace will do, thanks. I'm only a substitute myself. The burglar who looks after this territory is away on vacation."

•

Eager Beavers

Two drunks were looking at Hoover Dam. One said to the other: "Man, those crazy beavers!"

•

Close Shave

A lunatic, after a very good record of sanity, was discharged from an asylum and returned home. The following morning he decided to shave as every sane man does. He nailed the mirror to the wall, stood before it, lathered his face, then selected an old-fashioned razor, proceeded to shave; at this moment the nail slipped and the mirror fell to the floor. He stood gazing at the blank wall, then remarked bitterly: "Just my luck, second day out, and I've cut my blooming head off."

"Must you emphasize everything you say?"

Medical or Surgical

First Little Boy (in hospital ward): "Are you medical or surgical?"

Second Little Boy: "I don't know—what does that mean?"

First Boy (disgusted): "Were you sick when you came or did they make you sick after you got here?"

•

Two Heads

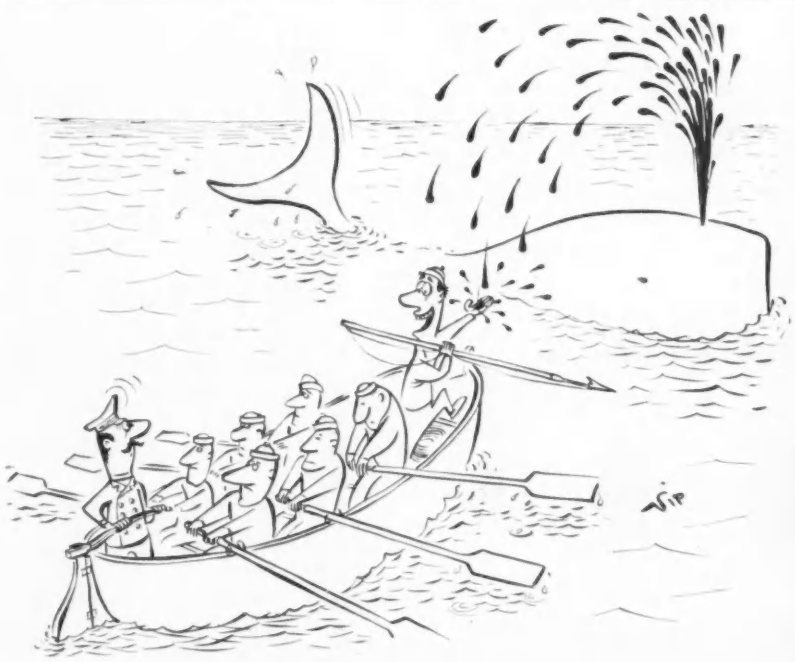
Said one angry twin to the other: "If it wasn't for me, you'd have two heads."

•

Age Restriction

Roberta: "There's a lot of talk nowadays about a woman president. Do you think we will ever have one?"

Ruth: "No, of course not. A president has to be at least 35 years old."



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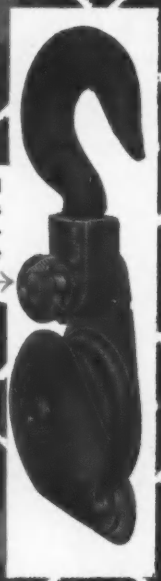
CORE LAB

"Truly, 'tis a gem."



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Box 2496 Tulsa, Oklahoma

World Travelers

The American tourist was looking down into the famous Greek volcano. Finally he commented, "It sure looks like hell."

"Oh," retorted his guide, "you Americans—you've been everywhere!"

•

Easy to Please

A rather inebriated gentleman left the night club, and as he went out the door, saw an elegantly dressed man in a blue uniform with gold braid and all.

Assuming this to be the doorman, the souse called, "Doorman, get me a cab."

Drawing himself to his full height, the uniformed gentleman replied, "Sir, I am a naval officer."

The souse blinked, thought a moment, then said, "Well then, call me a boat, I got to get home."

•

No Problem

"I know I'm not much to look at," admitted the suitor.

"Oh, well," philosophized his bride-to-be, "You'll be at the office most of the time."

•

The Safe Cracker

A drunk wandered in at 3 a. m. after a glorious evening. A few minutes later, a series of unearthly squawks howled out of the radio. His wife looked into the room and found him frantically twisting the dial back and forth. "For heaven's sake, what in the world are you doing? she asked.

"G'way. G'way. Don't bother me," he yelled. "Somebody's locked in the safe and I've forgotten the combination."

•

Honesty

"Have a good night?" the hostess asked sweetly of the house guest who had slept on a couch.

"Fairly good," he answered sleepily. "I got up from time to time and rested."

•

Color Scheme

A green giraffe, a plaid rat and a purple snake ambled into a local bar.

"You're a little early, boys," said the bartender. "He ain't here yet."

•

The Other Woman

Clerk: "Sorry, Ma'am, but Mr. Gotcash has gone to lunch with his wife."

Mrs. Gotcash: "Well, just tell him his stenographer called."

"We got a pretty good fracturing job this time."

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